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**National Aeronautics and Space Administration
CONTRACT NUMBER NAS 1-430**

REPORT FOR JUNE, 1960

ISSUED JULY 15, 1960

Submitted by

Western Electric Company
INCORPORATED

DEFENSE PROJECTS DIVISION

220 Church Street N.Y. 13, N.Y.

In association with

BELL TELEPHONE LABORATORIES, INCORPORATED

THE BENDIX CORPORATION

BURNS AND ROE, INCORPORATED

INTERNATIONAL BUSINESS MACHINES CORPORATION

FOREWORD

This is the eleventh Project Mercury monthly progress report submitted to the National Aeronautics and Space Administration by Western Electric Company, Inc. and its associated Team Members: Bell Telephone Laboratories, Inc.; The Bendix Corporation; Burns and Roe, Inc.; and International Business Machines Corporation. The report has been prepared in accordance with instructions set forth in NASA Specification No. S-45B, dated October 30, 1959.

The report reviews the Western Electric Team's progress for the period June 1 through June 30 in implementing tracking and ground instrumentation systems to support the National Aeronautics and Space Administration's manned satellite program. The information in this report is based on the system being operational by January 25, 1961.

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I

PROJECT MANAGEMENT

ACTIVITIES DURING JUNE

Mercury Project Managers' Meeting No. 20 was held on June 1 in New York City and Meeting No. 21 was held at IBM, Washington, D. C., on June 22. At the IBM Space Computing Center on June 23, NASA and Team Members watched real-time channel in operation from the Demonstration Site and a simulation of the portion of the Mercury orbit between Cape Canaveral and Grand Canary Island.

During the month, component demonstrations of telemetry, capsule voice, timing, data processing, and transmission equipment were conducted at the Demonstration Site.

Construction began at Kano, Nigeria, and Guaymas, Mexico, and continued at Bermuda, Grand Canary Island, Zanzibar, Kauai Island, Point Arguello, and Corpus Christi. Modification of the Indian Ocean Ship continued and modification of the Atlantic Ship began on June 27. Bids were solicited for site construction at the White Sands and Eglin AFB stations.

A Verlort radar system was delivered to Bermuda and systems for Grand Canary Island and Muchea were shipped to their respective POE. Unclassified NS-30 pulse coders are being built at Reeves to replace the classified RU-352 pulse coders for four of the six Verlort systems.

Bell Telephone Laboratories and Stromberg-Carlson signed the final contract for displays and consoles for the Cape Canaveral and Bermuda control centers.

A demonstration was held at Cubic the week of June 20 to determine the adequacy of the proposed redesign of the acquisition aid equipment for compatibility with the capsule telemetry package. Indications were that the Cubic redesign is satisfactory but further tests will be required to prove-in the gear.

Two GFE C-54 aircraft were delivered to Friendship Airport, Baltimore, and will undergo modification to be used as instrumented aircraft.

Schedules

As a result of several conferences between W.E. and NASA, a new Project Mercury over-all master schedule was developed. The dates established are shown in the Over-all Project Schedule Chart in this report.

The site implementation interval was broken down into the following phases: 4 weeks to install equipment, 4 weeks for static tests, 2 weeks for site shakedown, 2 weeks for dynamic tests, and 4 weeks for operations training, with this latter interval occurring after the site readiness or operational date. The majority of M & O personnel will be phased-in to the site during the beginning of operations training.

As indicated, the normal period for shakedown is two weeks. However, at those sites where start of dynamic tests may be delayed due to the aircraft being involved in completing dynamic tests at another site, the period allotted for shakedown may be extended somewhat. In all cases, schedules will be consistent with the operational dates required by NASA.

The new site implementation intervals can be described as follows. The 4-week installation period includes equipment installation and installation tests of individual units and components. Subsystem tests of telemetry equipment, acquisition aids, intercommunications data equipment, etc., will be accomplished during the 4-week static test period. The 2-week shakedown period will involve integrated systems tests of the basic functions and simulated operations with GSFC. The system will be exercised with instrumented aircraft during the dynamic test period. The end of the dynamic tests marks the site readiness date.

Scheduling the instrumented aircraft for dynamic testing was one of the most critical areas that was resolved. Western Electric met with NASA at Langley Field and reviewed in detail the schedule for dynamic testing at each site,

NASA-DEMONSTRATION SITE,
WALLOPS ISLAND

IBM SPACE COMPUTING CENTER

CAPE CANAVERAL, FLORIDA

MERCURY CONTROL CENTER

BERMUDA

GRAND CANARY ISLAND

GODDARD SPACE FLIGHT CENTER

KAUAI ISLAND, HAWAII

CORPUS CHRISTI, TEXAS

POINT ARGUELLO, CALIFORNIA

GUAYMAS, MEXICO

MUCHEA, AUSTRALIA

WHITE SANDS, NEW MEXICO

KANO, NIGERIA

WOOMERA, AUSTRALIA

EGLIN AFB, FLORIDA

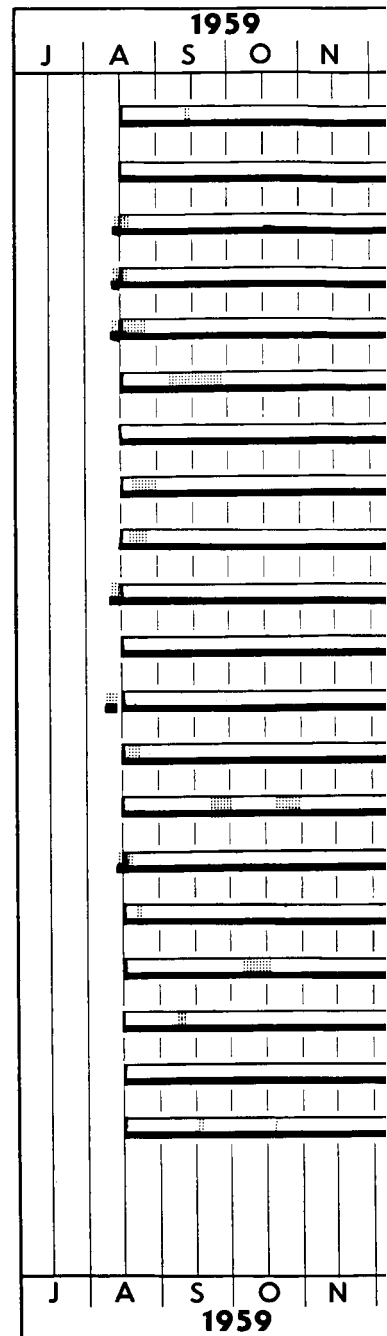
ZANZIBAR

CANTON ISLAND

INDIAN OCEAN SHIP

ATLANTIC SHIP

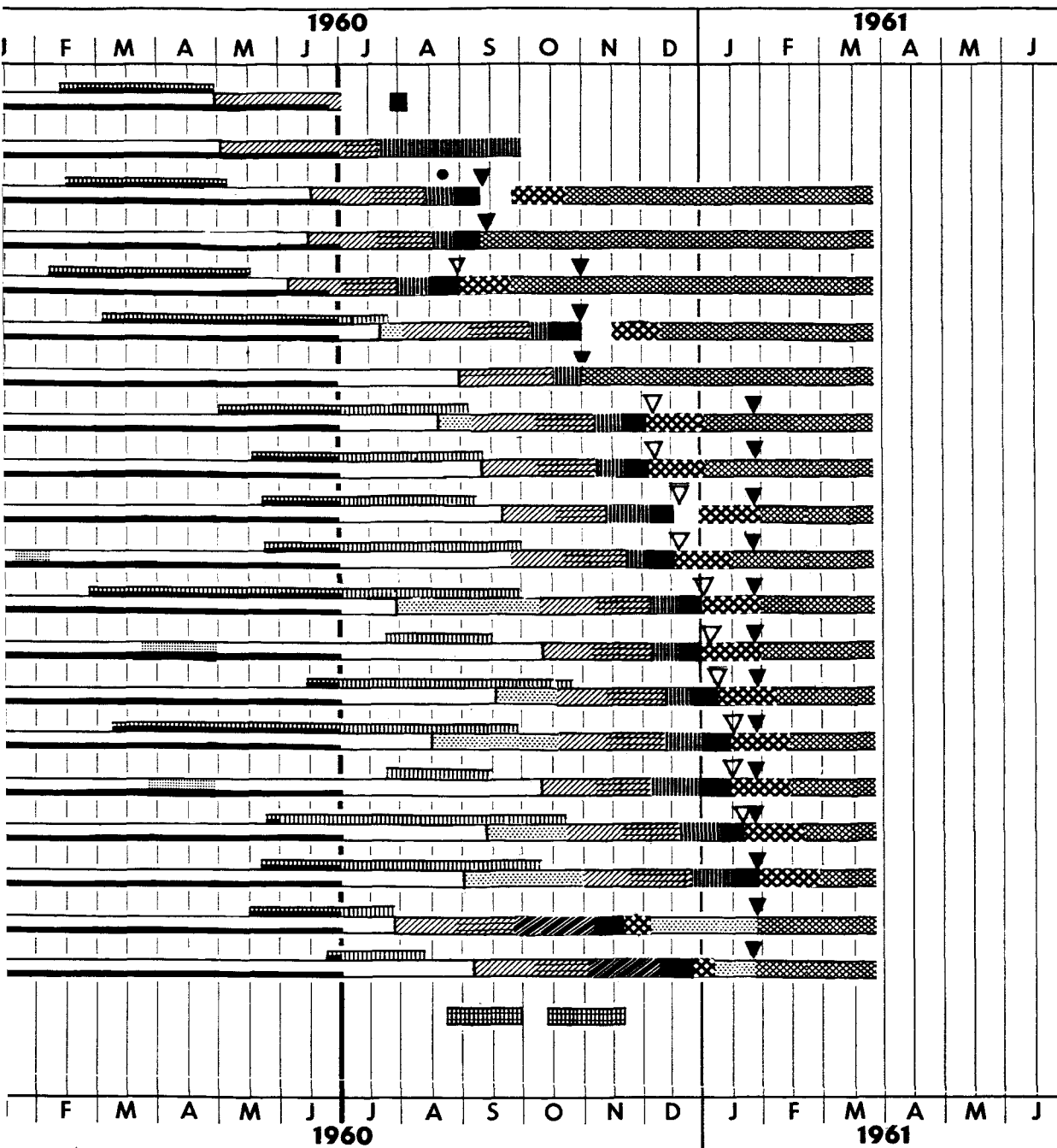
TRAINING



LEGEND

-  SURVEYS
-  PROCUREMENT
-  STATION DEVELOPMENT
-  OVERSEAS TRANSPORTATION
-  INSTALLATION

OVER-ALL PROJECT SCHEDULE



based on using three instrumented aircraft. The aircraft were allocated on a geographical basis. The DC-3 will be used to test North American sites; one C-54 will be used to test the Pacific sites; and the other C-54 will be used to test the Atlantic and African sites. This arrangement permits savings in time and distances of flights, with the exception of a flight plan for the Pacific plane which calls for it to fly to Hawaii, return to Point Arguello, and then fly to Australia. Western Electric is investigating the possibility of moving up the Point Arguello readiness date to permit rearrangement of the Pacific plane schedule so that it may be used in testing Point Arguello and then proceed in turn to Hawaii and the Australian sites, eliminating the backtracking between Hawaii and Point Arguello. Preliminary reviews indicate that this arrangement can be made.

The over-all Mercury program is progressing satisfactorily and all major milestone target dates are being met. All major equipments have been shipped and are on site at Bermuda, Cape Canaveral, and the two down-range stations.

The FRW-2, which is GFE to Wallops Island, was shipped on June 21 and was expected to arrive on site June 30. The only remaining shortage at this site is the dipoles for the acquisition aid equipment. Engineering problems regarding the dipoles are being worked out between Canoga, W.E., and Bendix Radio. About 60% of the Canary Island equipment has been shipped and is either at the staging area or en route to the site. The telemetry package is expected to arrive at the staging area by July 8.

Demonstration tests at Wallops Island consist of component equipment tests, subsystem tests, integrated subsystem tests, and dynamic tests. Component equipment tests of the telemetry system are 75% complete; timing and data processing and transmission are 80% complete.

On July 15, command system component demonstrations will begin. Telemetry will be the first subsystem to be demonstrated; this is scheduled to start on July 10. Dynamic testing, using instrumented aircraft, is scheduled to begin August 1.

Team Members reported the following approximate completion percentages: engineering

design studies 81%; detailed engineering 79%; major equipment procurement 64%; subsystem manufacture and demonstration 34%; computing, utilities, and rental 85%; site construction 45%; installation and site tests 22%; over-all system demonstration-operator training 18%; spares and replacement parts 22%; and transportation and warehousing 24%. The over-all project is approximately 55% complete.

Issues 13 through 16 of the Inter-Team Member Open Item Report, published during the month, reflect a total of 75 open items. There were 47 added during June and 50 were completed.

The Mercury scheduling organization is now expediting a GEEIA order which was placed with the Western Electric government sales group calling for communications equipment to be delivered to Cape Canaveral. Certain items on this order are required for the Mercury program. W.E. is endeavoring to meet the 30-day delivery schedule placed on this order. However, many of the items involved are nonstock and must be made in various W.E. shops. On these particular items, it is practically impossible to guarantee the 30-day delivery request. However, W.E. is endeavoring to expedite these items to be delivered on the earliest possible date.

Contracting and Funding

The total C & E funds authorized to date under the definitive contract amount to \$33,058,690. The definitization of CCN No. 13 (Supplemental Agreement No. 7) increased the total value of the basic contract by \$15,125, and the special R & D funds to \$33,073,815. In addition, a cumulative total \$524,111 has been authorized to date by CCN action, with the receipt of CCN's 29 and 30 for \$11,200 and \$75,000, respectively.

Western Electric has submitted to NASA firm quotations for definitization of the following additional CCN's:

3. Cancellation of one SCR-584 radar;
4. Training simulation—Cape Canaveral;
6. Dynamic tests by the use of range simulators to check tracking performance of the radars;

7. Refurbishing six GFE SCR-584 radars for conversion to Verlor radars;
10. Data reduction system;
11. Two KY-171/URW coders for the FRW-2 transmitters at Point Arguello;
14. Incorporating the *Plan for the Project Mercury Tracking and Ground Instrumentation System at the Atlantic Missile Range*;
18. Peak speech clippers (considered within the scope of the contract, no cost or fee);
19. Error indication system for Kano, Zanzibar, and Canton Island;
22. Deletion of 32 contractor-furnished HF radio receivers to GFE.

In addition, order-of-magnitude cost estimates were submitted to NASA on the following MCO's:

29. Crystals for 20 HF transmitters—\$2,800;
36. Five channel recorder-reproducers—\$26,000;
61. An additional boresight tower for the acquisition aid antenna at the Demonstration Site—\$42,000.

When the estimates submitted are approved by NASA, CCN's will be issued.

At the request of NASA, the following order-of-magnitude estimates were submitted to NASA:

1. Switching gear—London, England—\$15,600;
2. Five items of construction at Point Arguello—\$50,000;
3. Preliminary systems manuals for DOD—\$14,500.

The following additional CCN's have been received from NASA:

29. Procurement of Spare Parts for Diesel Generators;
30. Approves Spare Parts Production List No. 01 (Verlor Radars) for Bermuda, Guaymas, Cape Canaveral, White Sands, Corpus Christi, Canary Islands, Muchea, Hawaii, and Point Arguello.

32. Amends CCN 26 by correcting Items Nos. 6, 7, 8, 10, 12, 13, 14, 22, and 36 of Tab A.

A fully executed copy of Supplemental Agreement No. 7 covering the implementation of CCN 13 (TTY Spare Parts Production List No. 1W) into the contract, was received on June 21, and is being distributed.

Supplemental Agreement No. 8 was received from NASA for signature on June 17. A signed copy was returned to NASA on June 23 and a fully executed document was expected before the end of June. Supplemental Agreement No. 8 incorporates into the contract Addendum No. 2, dated May 27, which covers changes to S-45B agreed to by W.E. and Team Members.

Supplemental Agreement No. 9, covering the implementation of CCN 1 (Launch Subsystem) into the contract, was received for signature on June 23 and was signed and returned the same day. A fully executed document is expected before July 1.

Systems Engineering Group (SEG)

On June 27, SEG participated in a conference in New York City to determine the programming and provision of paper and magnetic test tapes. A meeting was scheduled for July 6-7 at Bendix Pacific to finalize the test data input tapes. The Bendix Pacific location was selected because of the availability of the equipment to produce the test tapes.

As a result of the SEG meeting of May 27, a special task group of Team Members under SEG sponsorship was formed to develop operational tests of the integrated subsystems. Meetings were held at Lincoln Laboratory and in New York City during June to review and revise these tests for application at the Demonstration Site. These tests are designed to give a qualitative evaluation of the basic Mercury system site design. They are scheduled for completion during July and for the earliest practicable application at the Demonstration Site.

During the month, Team Members met with NASA to consider means for calibrating test equipment. Site equipment presently includes a suitable d-c standard. Procurement action has been initiated for secondary a-c voltage standards. Arrangements have also been made to

train one technician at each site in the calibration and maintenance of test equipment.

Work also continued on subsystem test acceptance requirements for the Demonstration Site. On June 20, a conference was held at which Bendix Radio and W.E. reviewed the BTL preliminary draft of a test outline on the command radio subsystem. BTL will issue the final draft early in July. The acquisition subsystem test has been forwarded to NASA. The telemetry subsystem test will be distributed by July 1.

Technical Approvals

NASA approvals were received for:

1. The combined Bendix Pacific—W.E. proposal for the radar data control unit;
2. Bendix Pacific telemetry events buffer for Bermuda;
3. IBM digital junction box for Cape Canaveral.

Forwarded to NASA for informational purposes were details on the acquisition systems for Canton Island, Kano, Zanzibar, and the Atlantic and Indian Ocean ships.

Engineering Coordination

Information has been transmitted to BTL giving the primary and contingent recovery areas. Both areas will appear as a console display at Cape Canaveral, but only the primary recovery area will be displayed at Bermuda.

A final report on transmission of timing signals over cable at facilities has been prepared and transmitted to SEG for further action. This report was the result of tests performed jointly by W.E. and BTL.

Difficulties have been encountered with the acquisition system for Mercury. Representatives of NASA, BTL, Lincoln Laboratory, Bendix Radio, Cubic Corporation, Sandia Corporation, and W.E. attended a demonstration of Acquisition Aid System No. 6 at Cubic Corporation in San Diego, California, during the week of June 20. The receiver portion of the system is being modified to enable it to track telemetry signals without regard to the modulation index. The redesign was necessary because the present re-

ceiver was designed to track a telemetry signal whose modulation index was "1." Subsequent investigations disclosed that the capsule telemetry signal had a modulation index of more than "1."

Photo Documentation

The May Film Report to NASA included 173 scenes from the Demonstration Site, Cape Canaveral, Bermuda, Grand Canary Island, Kano, Zanzibar, Indian Ocean Ship, Muchea, Woomera, Canton Island, Kaua Island, Point Arguello, White Sands, and Corpus Christi and also showed some Bendix equipment. Photographs included in all film reports are supplied to W.E. by Team Members, site managers, and personnel traveling to the various stations.

To date, 774 slides depicting Mercury activities have been forwarded to NASA in film reports.

Personnel Manning

The Bendix Corporation added personnel to meet the schedules for the early sites. In addition, more manpower was needed to meet the required delivery dates for equipment involved in changes in the project, such as Cape Canaveral simulation training and Langley Field flight controller training.

Because Bendix is still in the process of adjusting its foreign manning requirements to allow for the extension of project schedules, the June foreign personnel forecast was not met.

PLANS FOR JULY

Systems Engineering Group (SEG)

Work will proceed on site acceptance requirements for other sites. BTL will begin the preparation of integrated subsystem tests incorporating operational procedures, as discussed with Lincoln Laboratory. SEG will continue work on the transmission of timing signals.

Instrumented Aircraft

Modifications will be accomplished before the end of July.

PERSONNEL MANNING

		1959					1960												1961		
		A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
BENDIX	FORECAST											359	367	300	231	119	101	91	83	28	21
	DOMESTIC																				
	ON ROLL	88	103	124	149	159	173	204	310	509	484	502									
	FOREIGN											63	62	84	128	147	163	163	119	74	57
BURNS AND ROE	FORECAST																				
	DOMESTIC											140	99	84	70	51	37	29	19	19	11
	ON ROLL	32	73	91	93	125	126	142	183	188	163	134									
	FOREIGN											35	39	36	32	21	10	7	5	5	1
IBM	FORECAST																				
	DOMESTIC											88	86	75	69	38	16	17	8	8	8
	ON ROLL	17	21	21	29	29	36	62	71	72	72	72									
	FOREIGN																				
WESTERN ELECTRIC	FORECAST																				
	DOMESTIC											186	225	218	199	178	148	121	98	79	70
	ON ROLL	42	75	93	104	110	130	142	157	175	179	185									
	FOREIGN											10	17	21	27	27	34	34	30	25	25
PROJECT TOTAL	FORECAST																				
	DOMESTIC											773	777	677	569	386	302	258	208	134	110
	ON ROLL	179	272	329	375	423	465	552	721	944	898	893									
	FOREIGN											108	118	141	187	195	207	204	154	104	83
TOTAL	FORECAST																				
	ON ROLL	4	6	4	8	12	25	41	76	109	64	87									
	FORECAST											881	895	818	756	581	509	462	362	238	193
	ON ROLL	183	278	333	383	435	490	602	797	1053	962	980									
		A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
		1959					1960												1961		

FOREIGN: PERSONNEL ASSIGNED TO LOCATIONS OUTSIDE CONTINENTAL UNITED STATES

DOMESTIC: PERSONNEL ASSIGNED TO LOCATIONS WITHIN CONTINENTAL UNITED STATES

Acquisition Aid Equipment

NASA will conduct tests with the redesigned acquisition aid to determine compatibility with the capsule telemetry package.

Project Managers' Meeting

Project Managers' Meeting No. 22 will be held on July 13 at 220 Church Street, New York 13, N. Y.

II

TEAM MEMBERS' IMPLEMENTATION REPORTS

WESTERN ELECTRIC COMPANY, INC.

ACTIVITIES DURING JUNE

Leased Communications

Southwestern Bell Telephone Company was requested on June 3 to furnish, install, and lease to NASA the on-site cables and intercom equipment at Corpus Christi. Included with the letter were copies of the site plan and cable layout and other material to aid in preparing construction plans.

Changes in circuit requirements for the demonstration and tests involving SCC, Cape Canaveral, the Demonstration Site, and Bermuda were confirmed in a letter to AT&T Long Lines and RCA Communications.

Correspondence has been conducted with the External Telecommunications Executive in London covering the staffing by Cable and Wireless, Ltd. (C & W) personnel of the Kano and Zanzibar HF and UHF radio equipment. A representative of C & W will meet with W.E. personnel in New York to discuss the arrangements required at the sites.

Western Electric has requested the Posts and Telegraphs Department, Kano, to install and maintain the cable connecting the transmitter site with the receiver site and lease it to NASA.

Intercommunications Equipment

On June 13-14, a meeting was held at Langley Field to review the completed design of the simulation intercom equipment. The design was approved and the interface connections finalized. Implementation of the design started immediately.

Radio Equipment

A project sheet has been issued covering requirements for a radio link between Grand Canary Island and nearby seaward elements for recovery operations. MCO 84, dated June 2, has also been issued to cover cost for modification of a spare transmitter and procurement of a receiver, antenna, and miscellaneous items of equipment. The NASA authorization for the change is contained in a telegram dated May 17. Arrangements for modification of a Gates transmitter being procured by Bendix have also been started. The frequency assignment to be specified by the Navy has not yet been furnished to W.E. It will be necessary to delay crystal procurement and lineup in the equipment until an assignment is made.

On June 10, W.E. forwarded a letter to NASA outlining the NBS approach for predicting the performance of high-frequency radio ground communication circuits and W.E. comments on such plans. The NBS proposal for warning service has been prepared by the North Atlantic Warning Service (NAWS) Branch and is under review by the bureau in Washington.

On June 24, W.E. forwarded a letter to NASA that outlines the status and most recent developments in connection with licensing of all Project Mercury radio stations. Attention was directed to possible delays that might occur if formal documents are not obtained to operate radio stations in foreign countries.

Meetings were held on June 13 and 20 in New York City to develop plans and schedules for the forthcoming prototype installation of HF radio equipment. Installation and testing of the

prototype system is scheduled to take place at Camp Kilmer, N. J., the Mercury storage depot, during July and August.

The proposal for the prototype system is covered in MCO 95, dated June 7. The prototype station will be patterned after the Zanzibar installation and will include all major components (including HF radio transmitting and receiving, UHF relay, and voice equipment). After tests are completed, the equipment will be reused at Zanzibar.

Teletypewriter Communications

On May 24, representatives of W.E. and BTL visited the Demonstration Site to investigate several items concerning teletypewriter design.

On May 27, three teletypewriter subsystem demonstrations were held at the W.E. Distributing House in New York. Those attending the demonstration represented AT&T Long Lines, W.E., and NASA. The transmitter sequencing equipment to be provided at a number of sites and GSFC was demonstrated, together with the specific features designed to meet Mercury requirements. NASA representatives expressed satisfaction with the demonstration.

Test procedures have been completed for use by W.E. shops to verify the accuracy of their mechanical work in connection with the installation of selector parts in the stunt box of the 28-RO teletypewriters.

Equipment Engineering

During the month, equipment engineers visited Cape Canaveral and Bermuda to provide detailed information for the interbay wiring of the intercom system and to assist in the terminating of cables at the distributing frames. In addition, a review of the status of installation was held.

Preliminary negotiations were begun with the Hawaiian Telephone Company and the General Telephone Company in connection with possible leasing to NASA of equipment at Hawaii and Point Arguello, respectively.

Training

The W.E. training and instructions organization was given the responsibility of preparing the alignment and test procedures for the HF radio ground-to-ground equipment to be tested at Camp Kilmer during the period June 30 to August 20. These procedures will be incorporated in the system manual for this system.

Testing and evaluation of the FPS-16 and MOD II radars are being conducted by W.E., BTL, and AT&T at Eglin and Cape Canaveral. These tests are being made to determine the intensity and pattern of radiation to which operating personnel will be subjected, and to establish an effective safety program to preclude the possibility of harmful effects. Various testing equipments and associated testing techniques are also being evaluated. Results of these tests will determine the necessary safety precautions to be incorporated into the *Plant Operating and Maintenance Procedures Manual* under preparation by W.E.

Work was started on the Mercury site simulation and team drill requirements, with four engineers assigned to the effort. A detailed memorandum on this subject was submitted to NASA on June 8. A general analysis of the team drill requirements is underway and the production schedule should be complete by the first week in July. It appears that this work will require approximately two to three months to complete.

Instruction Manuals

The preliminary draft of the *Flight Controller Manual* is expected to be ready for initial printing during the first week in July.

Two preliminary equipment manuals, one preliminary system manual, and *Introduction to Project Mercury and Site Handbook* were distributed to NASA.

NASA requirements for system and equipment manuals have been received. MCO 76 is being prepared to cover the additional negotiated number of final manuals required for Project Mercury. MCO 130 is under preparation to provide preliminary system manuals for use by DOD in training of M & O personnel.

Work will continue on system and equipment manuals.

PLANS FOR JULY

Training

The alignment and test procedures for the Camp Kilmer HF radio test will be completed

and used for the installation, testing, and training program at Camp Kilmer.

Equipment Engineering

It is anticipated that all interface connecting details for the Demonstration Site, Cape Canaveral, and Bermuda will be finalized.

BELL TELEPHONE LABORATORIES, INC.

ACTIVITIES DURING JUNE

BTL and Stromberg-Carlson signed the final contract for displays and consoles for the Cape Canaveral and Bermuda control centers. Installation at the control centers is on schedule and static testing should be completed by August 13 at Cape Canaveral and July 30 at Bermuda.

Work continued on operations plans for the various Mercury tracking stations. The operations plan for Bermuda, which was to have been released during May, was revised and changed in format before being issued in June. A similar plan for Cape Canaveral will be issued in July.

A meeting was held during the week of June 20 at Cape Canaveral among NASA, AMR, Team Members, and W.E. to settle problems associated with the interface between the operational system and the simulator. Simulation for Cape Canaveral is on schedule.

The first phase of the traffic analysis of the Mercury TTY system was completed. It revealed the anticipated traffic loads for the shared TTY circuits between GSFC and the remote stations. The results of this study are expected to be released by July 1. The second phase of the traffic analysis was begun and will include: (1) studies of the adequacy of the GSFC switching

system, (2) traffic loads for the circuits to U.S. stations and Bermuda, (3) traffic loads for the GSFC—Cape Canaveral circuits, and (4) message delays for the entire network.

The Mercury Interference Committee is preparing a preliminary report on the interference situation for the Atlantic Ship. As has been anticipated, it will be difficult to receive on the ground-to-ground and on the air-to-ground circuits while the high-power ground-to-ground transmitters are in operation. This situation will be resolved after it is determined how much selectivity can be put in the special filters that will be required.

Work is continuing on the specification for the system tests to be conducted at the Mercury stations during acceptance testing. On June 17, the Technical Acceptance Test Specification for the Telemetry Receiving and Display Subsystem was sent to NASA and W.E. This is to be used as a model for Team Members for the subsystem test specifications. Work began on the preparation of procedures to be used in the integrated subsystem tests at the Demonstration Site and some of the other stations. These tests are intended to demonstrate qualitatively the adequacy of the equipment for the Mercury task when the operators are included.

THE BENDIX CORPORATION

ACTIVITIES DURING JUNE

Systems Engineering

Three Verlort radar systems were shipped: one to Bermuda and one each to the POE's for

Grand Canary Island, and Muchea, Australia. New NS-30 pulse coders, which are unclassified, are being built at Reeves Instrument Corporation to replace four of the RU-352 pulse coders in the Verlort radars for Grand Canary Island;

Muchea, Australia; Guaymas, Mexico; and Corpus Christi, Texas. The scan generators in the radars will be evaluated on site to determine their adequacy and the requirement, if any, for the transformer modification proposed by Bendix.

The first radar range simulator units from Remanco for the FPS-16 were delivered in June. Reeves is presently working on a simulator for the Verlor radar. All designs for the data switch unit are complete; production is being initiated and no problems are expected.

Information required on the radars at Eglin AFB, Florida, was obtained directly from the radar manufacturers. Based on this information, the specification for the polar-to-cartesian coordinate converter for Eglin AFB was completed and submitted to Milgo Corporation for prices and delivery schedules.

Detailed technical descriptions of acquisition systems used on the Atlantic and Indian Ocean ships; Canton Island; Kano, Nigeria; and Zanzibar were submitted to W.E. Acquisition data consoles for the Demonstration Site, Bermuda (2), Cape Canaveral, Grand Turk Island, and Grand Bahama Island were built, tested, and shipped. The console for Grand Canary Island is now in test. Cubic Corporation outlined their proposed redesign of the acquisition aid equipment for compatibility with the capsule telemetry package. A demonstration was held at Cubic during the week of June 20 to determine adequacy of design, and NASA approval of the Cubic redesign was given on June 26.

The communications technician's consoles for the Demonstration Site, Cape Canaveral, Grand Bahama Island, Grand Turk Island, Bermuda, and Grand Canary Island were factory-tested and shipped to the sites; the Muchea, Australia, and Indian Ocean Ship consoles are in fabrication.

Testing of the 100-watt high-pass filter for the FRW-2 was completed on May 31. Some changes in capacitors were required, and further tests were scheduled. The 10-kw low-pass filter was completed on June 8, and tests on this unit indicated that some changes in the inductive elements would be needed. Further tests were scheduled. These filters for three sites should be ready for delivery by July 15. Installation

of these filters at the sites is expected to be quite simple.

The systems test on the Bermuda system was completed at Alpha Corporation on May 27. The system included two FRW-2 transmitters and one 240D-2 amplifier system. The systems test was satisfactory and the system was shipped to Bermuda on June 25.

All of the first set of capsule equipment except final approved subcarrier oscillators were received. NASA informed Bendix Radio that McDonnell Aircraft will not be required to provide connectors for the capsule equipment. Bendix Radio has, therefore, procured all the necessary connectors for the first system. The two GFC C-54 aircraft to be used as instrumented aircraft were delivered to Friendship Airport, Baltimore, Maryland. An inspection revealed some deficiencies and the aircraft were sent to La Guardia Field for further checkout by a firm familiar with the C-54. When this is completed the airplanes will be returned to Friendship Airport.

The telemeter events buffer was completed and shipped to the Bermuda site. The telemeter events transmitting buffer for Cape Canaveral was modified to incorporate two additional features: one providing for redundant transmission of information and the other permitting control of the unit from an external location for post-capsule flight analysis. The equipment—designed, fabricated, modified, tested, and accepted within a period of 112 working days—was shipped to Cape Canaveral on June 10.

Radar data control units for the Demonstration Site, Bermuda, and Cape Canaveral were completed and shipped. One digital synchro data transmission system and one special receiver have been completed and shipped to Cape Canaveral; one additional system was shipped to Grand Bahama Island.

Work progressed satisfactorily on the capsule telemetry simulator. All sheet-metal work was completed and chassis wiring is in progress. The capsule telemetry equipment, two transmitters, and power supplies received from Bendix Radio were used for checking the mechanical design and wiring compatibility. Most components have been ordered and received.

The fine monitor equipment has been shipped

to Cape Canaveral. Ninety-five per cent of all telemeter display parts for the Cape Canaveral and Langley Field trainer simulation equipment have been placed on order. Work on the over-all schematic and wiring diagram is nearing completion.

The basic design for the flight controller trainers for Cape Canaveral and Langley Field has been completed. Subsystems are being fabricated and assembled for inclusion in the major units. Preliminary interface drawings are in preparation and preliminary parts lists have been completed. Finalized equipment lists and schedules were forwarded to Bendix Radio and Western Electric. Detailed packaging and shipping arrangements were worked out with the prospective vendor.

Procurement and Production

Purchase orders for all major new-scope Bendix Pacific equipment have been placed, with the exception of the tape recorder/reproducer for Guaymas, Mexico, and the data reduction center at the Cape Canaveral Control Center, and the 17-inch oscilloscope for the latter site. The airborne magnetic tape recorder for the capsule telemetry simulator has been ordered. Procurement of the flight controller trainer equipment is proceeding satisfactorily; approximately 25% of the major items have been received. Placement of purchase orders for spare parts has been initiated. Quality assurance inspections were conducted on all received vendor equipment, including large quantities of operational spare parts. Major efforts were concentrated on the electrical verification of vendor-furnished equipment.

All items of digital data processing equipment for Cape Canaveral and the majority of telemetering items were tested and shipped. In-plant testing of the Grand Canary Island telemetering system was started on June 5 and check-out of the digital data processing equipment was successfully completed.

Instruction Books and Training Manuals

The preliminary instruction manual for the capsule communication system was shipped to

the Demonstration Site. Vendor-furnished manuals for the active acquisition aid, the A/D transmitter, the D/A receiver, the plotting board, and the UHF voice transmitter are currently being reviewed by Bendix Radio for acceptability.

Instruction manuals for all original-scope, vendor-furnished equipment have been received by Bendix Pacific, with the exception of those for the Milgo equipment. Expediting efforts have resulted in a commitment to deliver one set of preliminary instructions to Wallops Island in the immediate future. Preparation of handbooks for Bendix Pacific-manufactured items of equipment and updating of the preliminary system manuals have continued.

Schedules have been published for the support engineer training courses covering the Bendix Pacific telemetering and digital data processing systems, beginning July 7 and August 3.

Site Implementation

By the end of the month, Bendix engineers and technicians were assigned to field installation at the Demonstration Site, Cape Canaveral, Bermuda, and Grand Bahama Island. Additional field engineering personnel are working with design engineering, are engaged in planning for future installation activities, or are attending specialized schools.

PLANS FOR JULY

Systems Engineering

Construction and testing of acquisition data consoles for the remaining sites will continue. It is expected that sufficient information will be made available to allow completion of cabling information for both Cape Canaveral and Bermuda. Cabling information for both Grand Bahama Island and Grand Turk Island will be completed and work will begin at the Canary Island and Muchea, Australia, sites and on the Indian Ocean Ship.

The three remaining digital synchro data

transmission systems will be completed during the next reporting period. The special clocks required for the flight controller trainers will be ready for testing.

All drawings required for telemetering receiving equipment for the data reduction center at the Cape Canaveral Control Center will be completed by July 1 and installation drawings for shipboard equipment will be completed.

All hardware and fabricated parts are to be installed in the flight controller trainer display console, and all interconnecting wiring will be completed.

Procurement and Production

Procurement efforts by Bendix Pacific will include the placement of the remaining orders for spare parts as well as equipment needed for Guaymas, Mexico. Delivery of the airborne magnetic tape recorder for the capsule telemetry simulator is expected early in the month. Receipt of a major portion of vendor-furnished

flight controller trainer equipment is expected by July 1. Delivery of long-lead items will be expedited as necessary.

Assembly will be completed of the Muchea, Indian Ocean Ship, Kauai Island, Woomera, and Zanzibar site equipment. Electrical checkout of these systems will be started. Quality control planning also includes continued processing of all vendor equipment and parts, as well as electrical checks of all Bendix Pacific-manufactured items. Accelerated preparation of operation instructions will continue.

Instruction Books and Training Manuals

Completion by Bendix Pacific of all original-scope equipment handbooks is expected during the next reporting period. Finalization of the system manuals will continue and support engineer training courses will be conducted. Bendix Radio will continue work on equipment and system manuals to prepare them for final publication.

BURNS AND ROE

ACTIVITIES DURING JUNE

Construction work in accordance with base contracts is complete at the Demonstration Site and Cape Canaveral, and B&R is now engaged in M & O activity at these stations.

In June, construction work began at Kano, Nigeria, and Guaymas, Mexico; and construction continued at Bermuda, Grand Canary Island, Zanzibar, Kauai Island, Point Arguello, and Corpus Christi. Retrofit work began at Cape Canaveral.

Modification of the Indian Ocean Ship, *Coastal Sentry*, continued, and modification of the Atlantic Ship, *Rose Knot*, was scheduled to start by the end of June.

Bids were solicited by B&R for site construction at White Sands and Eglin AFB. In addition, order-of-magnitude estimates for retrofit work at the Demonstration Site were rendered to W.E., and B&R is awaiting authorization to proceed.

About 96% of prepurchased equipment has been released from the vendor's plants to the East and West Coast warehouses, shipyards, and domestic stations. All prepurchased equipment required at the overseas stations has been booked for commercial overseas transportation and it is estimated that 95% of all prepurchased equipment required at these stations is at, or en route to, the sites.

Burns and Roe is continuing to develop the Real Property Equipment Operation and Maintenance handbooks for all sites. Spare parts requirements for all stations are being developed and listings will be processed in accordance with W.E. instructions.

PLANS FOR JULY

Construction is expected to begin at Eglin AFB and White Sands. Construction at the Bermuda and Canary Island stations and mod-

ification of the Indian Ocean Ship, *Coastal Sentry*, is scheduled for completion by the end of July.

Burns and Roe will, therefore, be engaged in construction, modifications, and retrofit work at almost every station during the month of July.

INTERNATIONAL BUSINESS MACHINES CORPORATION

ACTIVITIES DURING JUNE

Systems Design

A meeting was held with W.E. representatives on the configuration and interrelationship of the TTY system operating with the real-time channel TTY subchannels. Representatives considered the problem of: (1) the simultaneous presentation of TTY radar from one site to two real-time subchannels, and (2) the inability to recoup messages which the computer had usurped because of failure to obtain normal end-of-message coding after addressing the computer with radar data.

The first problem will be solved by having the monitor program use one subchannel as prime source and revert to the second when data from the first is being received incorrectly. The second problem will be resolved (with NASA approval) by adding another TTY output which will be used to print the message received, from the detection of the error in the data until the next end of message was received. The operation of the radars (FPS-16, Verlor, and MPQ-31) was clarified with NASA and Bendix. The conversion factors are proper to reconvert the octal TTY numerical code to the proper binary equivalents.

Programming

Work continued on the coding and testing of all phases of the Project Mercury computing system. The launch phase registered considerable progress in the planning and coding of all sections. Progress in the output area was hampered by changes in acquisition formats and the additional requirement of special outputs from GSFC to Bermuda. The monitor phase registered its progress in the systems testing area

and in the preparation and testing for the Wallops Island demonstration. Other progress in monitor was stalled by revisions in output and launch specifications, and by the need to consider proposals for other modifications to the system.

Subsequent to last month's report, there have been several meetings during which significant developments occurred. On May 24, a meeting was held at the SCC with representatives from NASA, B&R, and Geonautics, Inc. to review progress in the site surveying and to reconfirm requirements. On May 25, a meeting was held at SCC with NASA representatives to discuss standard error calculation, weighting, orbit capability, and plotboard at GSFC. At this meeting, IBM was advised of requirements for GSFC special output to Bermuda and the possibility of a more elliptic orbit. A meeting was held May 31-June 2 at the SCC with W.E. representatives to discuss low-speed TTY address code changes. On June 8, a group of IBM representatives visited the Wallops Island site. The visit was very profitable, especially because it provided an opportunity to see the consoles, radar, acquisition aids, converters, and TTY equipment.

On June 6, 7, 13, and 14, Dr. Paul Herget, IBM consultant, met with IBM programmers to discuss launch phase, Bermuda phase, edit, orbit capability, and, especially, testing procedures for the differential correction process. On the latter, he aided in IBM attempts to establish an orbit standard as a basis for measuring the effectiveness of the process under a variety of perturbed input conditions. His visits to the SCC will be more frequent than during the past few months. On June 13, STG representatives met at the SCC to give final approval to all specifications in the launch phase. Only a few details remain to be finalized.

Goddard Orbital

The low-speed input program was completed, except for boresight correction and additional magnitude check. Considerable progress was made on the planning of the GSFC high-speed input program. IBM virtually completed the programming of the low-speed edit program and is now making several test runs for evaluation. The plotted results of these tests seem to indicate that IBM will have to modify its present method. Initial testing of the complete orbit phase programming system using error-free orbit and random-error orbit simulation tapes showed remarkable convergence success with the proposed differential correction techniques. Intensive investigation of test results led to modifications of the basic control differential correction programming which will further improve the correction process. The coding of the program that calculates the time to fire retrorockets, given a specified landing area, or generates the re-entry trajectory for a given time of retro-rocket firing, was completed, except for the calculation of elapsed capsule time to retrofire and the corresponding incremental clock settings. Test calculations have been prepared and testing begun. The program that computes acquisition data for remote sites was completed and is ready to be incorporated into the Mercury system. The program that computes all the output for the Cape Canaveral displays, except retrofire times and corresponding landing points and orbit capability, was coded and is partially checked out. The output programs have suffered a great deal from various changes during the past month. The acquisition data program, completed only recently, had to be discarded because of a drastic change in the format; the new version is being written. IBM needs a program for special TTY outputs from GSFC to the Bermuda Control Center. It also needs a program that handles the clocks (or times) relating to retrofiring. The GSFC plotboard display program is near completion. In the GSFC orbital phase of the monitor program, simulated testing is continuing with the differential correction program, which has under-

gone substantial alteration in the past month. Monitor's control over high-speed output was checked out and incorporated into the system. Low-speed output routines were rewritten to conform to changed specifications. The Wallops Island demonstration was prepared and tested with available TTY equipment. High-speed test patterns sent from Wallops Island were received in the computer and logged successfully on magnetic tape. Data sent from a local TTY transmitter was received and sent to the local TTY printer.

Final checkout of the complete simulator program is being conducted. This program will enable IBM to generate launch data (Burroughs GE, IP 709, and radar) and corresponding orbit and re-entry observations for all sites. This includes the powered and unpowered observations over Bermuda. Tests were run using previously computed orbit information. IBM is delaying the generation of additional tapes until it receives the new r and v for an elliptic orbit from NASA. IBM received a second set of data from STL, which contains Burroughs/GE data for a typical launch. This data also contains the associated direct display information that will be used for the open-loop simulation. IBM also has operational IP 709 data for eight launches.

Bermuda

The past month was used to polish up the editing, smoothing, and short-arc routines of the Bermuda programs, bring the loose ends together, and coordinate their use with monitor. The Bermuda monitor system was organized and compiled and monitor/simulator operation was tested. Tests will be made, using the Bermuda 709 machine with its unique configuration of on-line equipment. Bermuda high-speed input will be tested with real-time equipment, and the Bermuda telemetry input routine is coded and partially checked out. An interim program for Bermuda high-speed input data is being written to be tested with the monitor system at Bermuda. Until incorporated into the Bermuda system and tested as a unit, it is doubtful that any more changes will be made.

Launch Phase

The specifications for the launch programs are complete with the exception of some details concerning the re-entry phase, and the treatment of raw radar data. The majority of the basic agreements were written for the monitor program controlling launch, including those on input and output transmission and format. Monitor control logic during launch is almost completely formulated. Flow diagramming of monitor launch routines began again after revised specifications obliterated previous work. Additional programmers were assigned to the coding and testing phases. IBM expects to be on schedule at the end of July.

Mercury Control Center Simulation

The Mercury Control Center and Bermuda open-loop programs were coded and are being checked out. The latter program will read a previously prepared Bermuda monitor log tape and present the display data over the high-speed lines in real time. The final checkout of these programs must wait until IBM has tapes that were actually written by the monitor program. These tapes will be prepared using the regular simulation program. Programming of the closed-loop system is underway.

Special Equipment

Over-all procurement (manufacturing) of special equipment is approximately 75% complete. Installation plans are complete for all areas. Tools and test equipment are complete and in process of being shipped. Personnel assignments to Bermuda, Cape Canaveral, and SCC will have been implemented by the end of the month.

Unit test of the real-time channel at the SCC is progressing steadily despite the many problems encountered in effecting interface with TTY and high-speed receiver equipments. These problem areas were resolved by the respective Team Members.

Diagnostic checkout of the TTY program (loop and output) is approximately 75% completed. The input diagnostics are checked out.

Diagnostic checkout of the high-speed input programs cannot be accomplished until the four channel receivers and transmitter are installed. This installation is scheduled by the first week in August.

Checkout of the 709 system at Bermuda was accomplished on schedule. A few minor problems involving air conditioning and power regulation are evident and are being reconciled with the proper Team Members.

Unit test of the real-time channel progressed satisfactorily. Completion of this unit test depends on interface implementation with other Team Members. Preliminary analysis indicates that testing will be completed approximately August 15, 1960. All IBM-controlled cabling was delivered. All IBM equipment, with the exception of the transfer register, was delivered and installed. It is anticipated that the transfer register will be delivered and installed by the middle of July.

The switch unit, data quality monitor, digital junction box, and interface junction box were shipped. Installation of the duplexed telemeter events buffer is scheduled to begin on June 20. Other Mercury Control Center equipments necessary for the Cape Canaveral Local Test continue to be expedited. Items of equipment necessary to implement the interim test system by August 15 (SCC communication with Cape Canaveral) are also being expedited.

All IBM-controlled equipments for GSFC are on schedule.

Launch Subsystem Testing

IBM has delivered the following sets of Acceptance Test Requirements (ATR) to Western Electric: (1) Wallops Island Test; (2) Cape Canaveral Local Test; and (3) Bermuda Subsystem Test. The interim (SCC) launch subsystem test documentation is completed and ready for submission to W.E. Comments from W.E. on the Wallops Island test were received and are being incorporated into the test plan. Some special input/output programs were written to augment testing, and these programs are being checked. The Wallops Island demonstration, utilizing TTY and high-speed inputs, will be accomplished prior to July 1.

PLANS FOR JULY

IBM will continue its efforts on simulated system checkout. It will incorporate additional programs into the system and intensify its testing efforts of the mathematical models. The Bermuda system will be tested on the Bermuda 709. Delivery of the plotter to the SCC is expected. It will be used to test this program. The

real-time channel will be operative and the Wallops Island demonstration will exercise high- and low-speed transmission facilities. Real-time channel installation and interface checkout will be completed at Bermuda. The Cape Canaveral Local Test (ATR No. 2) will be accomplished. IBM will complete preliminary over-all launch subsystem test specifications and begin work on interference testing.

KEY TO IBM PROGRAM CHART

A. Rough Flow Chart and Functional Description:

A statement of the general functions and functional relationships of each major subsection.

B. Detail System Specifications:

The detailed statement of functions — what must be performed by each subsection.

C. Detail Flow Chart:

Shows in detail the relationship between each part, and carries the subsection diagrams at least one level deeper. Coding may proceed

directly from these charts and need not require full system comprehension on the part of the coder.

D. Coding:

Translation of the detailed flow charts into machine language (SOS or FORTRAN subroutines).

E. Checkout:

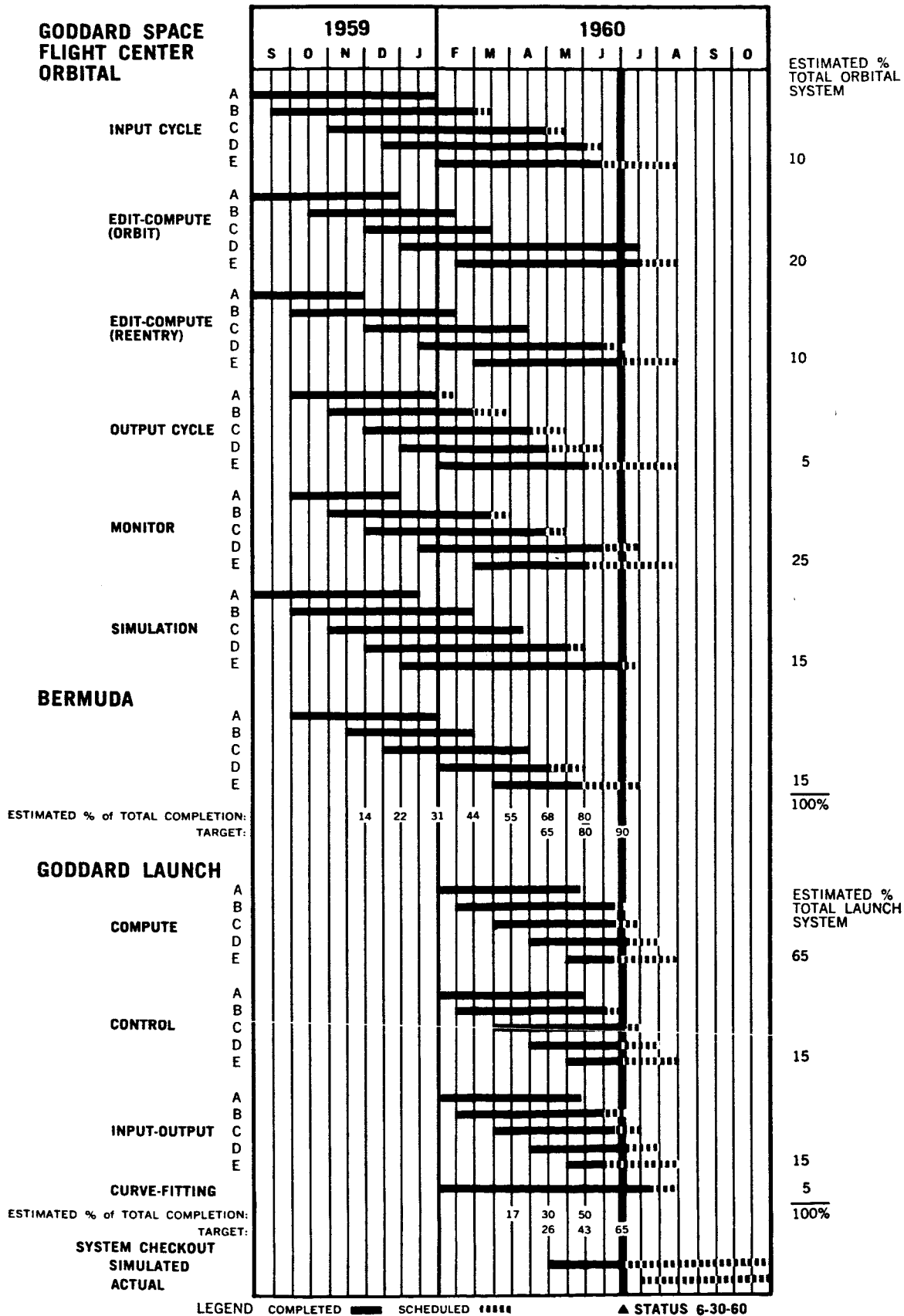
The establishment and trial of sets of test data for each subsystem by itself.

System Checkout:

The testing of the entire system in its actual environment.

IBM PROGRAM

GODDARD SPACE FLIGHT CENTER ORBITAL



MAJOR EQUIPMENTS

DESIGN AND ENGINEERING

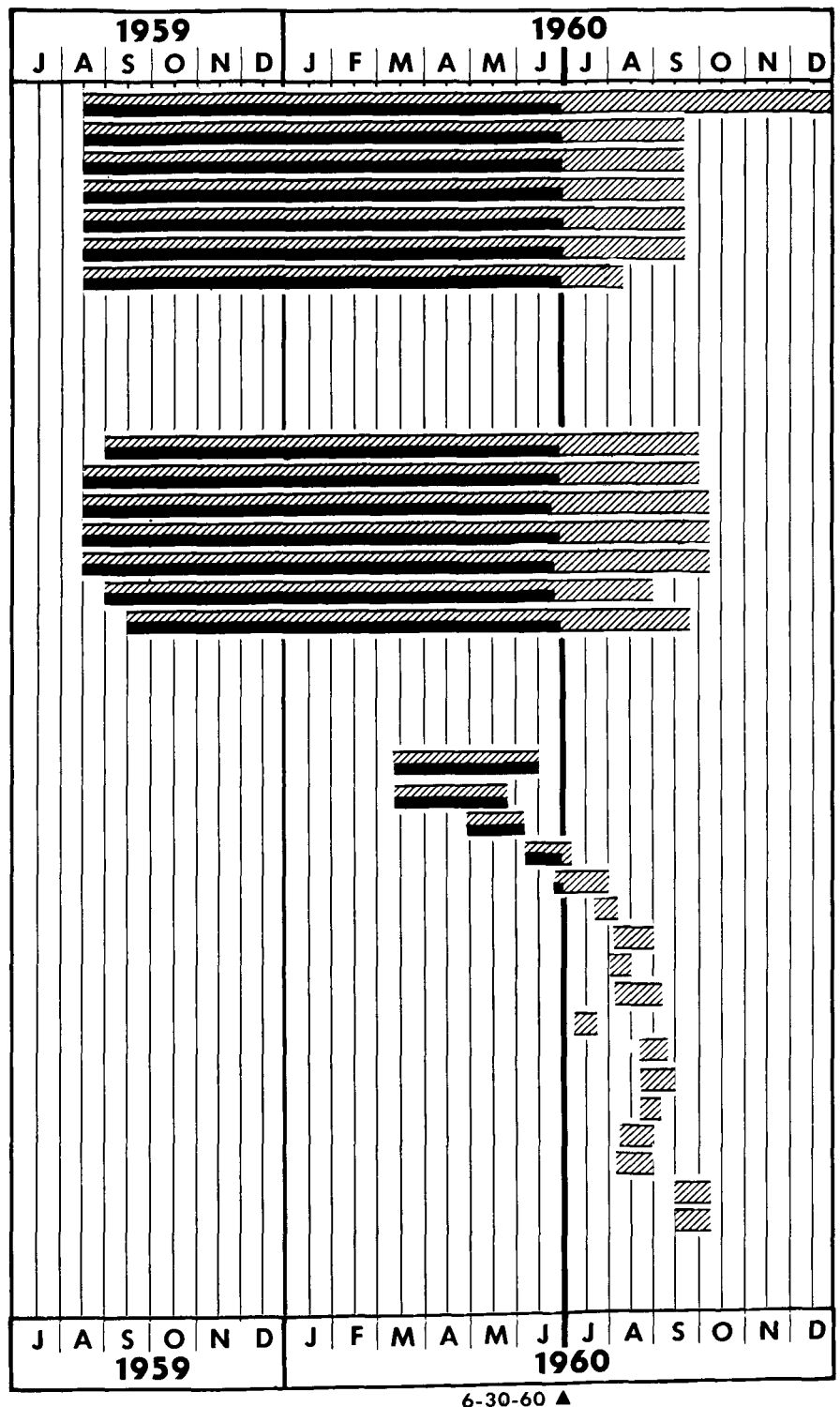
TELEMETRY
DATA PROCESSING
RADAR MODIFICATION
VEHICLE COMMUNICATIONS
ACQUISITION AIDS
GROUND COMMUNICATIONS

PROCUREMENT AND PRODUCTION

TELEMETRY
DATA PROCESSING
RADAR MODIFICATION
VEHICLE COMMUNICATIONS
ACQUISITION AIDS
SPECIAL DATA PROCESSING
GROUND COMMUNICATIONS

DOMESTIC TRANSPORTATION

NASA-DEMONSTRATION SITE,
WALLOPS ISLAND
BERMUDA
CAPE CANAVERAL, FLORIDA
GRAND CANARY ISLAND
MUCHEA, AUSTRALIA
WOOMERA, AUSTRALIA
ZANZIBAR
KAUAI ISLAND, HAWAII
KANO, NIGERIA
INDIAN OCEAN SHIP
GUAYMAS, MEXICO
POINT ARGUELLO, CALIFORNIA
CORPUS CHRISTI, TEXAS
CANTON ISLAND
ATLANTIC SHIP
WHITE SANDS, NEW MEXICO
EGLIN AFB, FLORIDA



LEGEND

SCHEDULED
 ACTUAL

OVERSEAS TRANSPORTATION SCHEDULE

EAST COAST PORT OF EMBARKATION

BERMUDA

GRAND CANARY
ISLAND

ZANZIBAR

KANO, NIGERIA

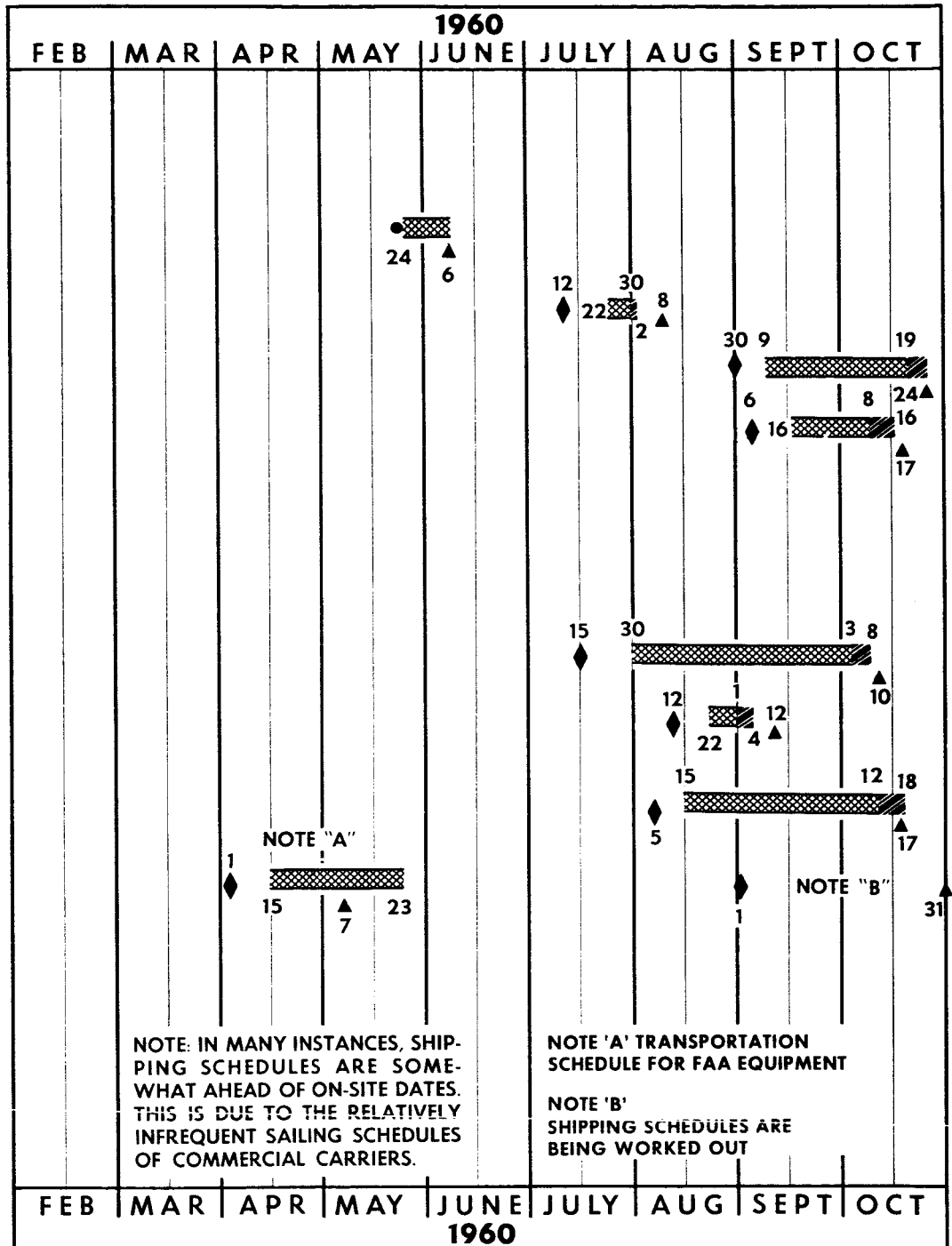
WEST COAST PORT OF EMBARKATION

MUCHEA,
AUSTRALIA

KAUAI ISLAND,
HAWAII

WOOMERA,
AUSTRALIA

CANTON
ISLAND



LEGEND

- ◆ LATEST ARRIVAL DATE AT WAREHOUSE
- ▲ DUE AT SITE
- DUE AT WAREHOUSE

- ▨ IN TRANSIT
- ▩ INLAND TRANSPORTATION

III

DETAILED PROJECT SCHEDULES AND STATION IMPLEMENTATION

This section highlights the status of implementation of Mercury stations and discusses consolidated schedules in design and engineering, procurement and production, and transportation to domestic and overseas stations.

Progress on each item is shown on the chart by the black portion of the bar. If the item is on schedule, the black portion is carried to the end of the month. If the item is behind schedule, the length of the line indicates the amount of work accomplished. The reasons for the delay, the impact on over-all schedules, and the action required to bring the item back on schedule are discussed in the narrative portion. Problems common to more than one site are discussed in the following paragraphs. Schedule problems pertaining to only one site are discussed under that site.

The Over-all Project Schedule Chart was revised to indicate the new scheduling intervals developed by W.E. and NASA during June. This chart, as well as each site chart, reflects the current schedule for dynamic testing, including the flyover of the instrumented aircraft. It is at the end of this activity that the site is considered complete and ready for NASA acceptance.

Over-all design and engineering for the major equipments is reported on schedule. This is reflected in the Major Equipment Chart and covers the basic Mercury program. However, on this same chart, delays are reported in procurement and production for data processing. The one-week delay in data processing is due to the late ordering of the polar-to-cartesian coordinate converter for Eglin AFB. During June, specifications for this unit were submitted to Milgo for price and delivery, and at this time, no delay is expected in implementing the Eglin site.

CAPE CANAVERAL, FLORIDA

The LH quad helix command antenna and the command and transmit pedestals have not arrived on site. These items were scheduled for shipment from Cubic on June 28. Installation at this site is progressing according to schedule. Even though the telemetry receiving and display equipment was delayed because of the recent work stoppage at this site, it is expected that this equipment will be installed and static-tested on time.

On June 21-22, representatives of NASA, McDonnell Aircraft, Stromberg-Carlson, Bendix, BTL, IBM, and W.E. attended a simulation interface cable conference at Cape Canaveral.

The McDonnell procedures trainer is scheduled to arrive at the site about July 3. Other simulation equipments will arrive and be installed during July and August.

Equipment installation at Grand Turk Island was held up three days because the Bendix installation team was delayed at Cape Canaveral to assist with equipment installation at the Mercury Control Center during the recent strike at Cape Canaveral. The team arrived and began installation on June 21. Erection of the transmitting antenna and receiving antenna towers is almost complete.

Erection of these towers at Grand Bahama Island is also almost complete. Telemetry and radio equipment is in place. Further progress awaits the arrival of cable and cabling information.

Final inspection of the erected towers at Grand Bahama and Grand Turk islands will be made by B&R representatives on approximately July 1.

BERMUDA

All major mechanical and electrical equipments were delivered to the site except for additional cable tray parts. Installation is now proceeding in all areas. IBM is exercising the computer and making it available to their programmers for test runs. Stromberg-Carlson has approximately 50% of their installation work completed, with all of their equipment on hand except wall maps. BTL is monitoring Stromberg-Carlson work and, with the assistance of IBM and Bendix, is planning for the testing phase. Bendix has been somewhat handicapped because of the lack of interconnecting cable between equipments. However, a large portion of the cable arrived near the end of the month.

The Telemetry, Control, and Computing (TCC) Building at Coopers Island is in its final construction phase. The air-conditioning units are operating on a full-time basis and are under automatic control. On June 21, RCA moved their first piece of equipment into the FPS-16 Building. The second floor was completed, and the first floor is nearing completion. The antenna tower was completed. The power building was painted and the interior partition erected.

The fuel tanks and the piping to the generators was completed. The connection of power to the Verlor radar stand was virtually completed. The equipment was on the air and tracking aircraft by June 17. The active acquisition aid tower was erected and the antenna put in place. The associated boresight tower foundations were poured and the erection of this, the last tower, awaits only the clearing of the RCA equipment from the area of the guy supports. The trenching for all remaining cables was started and the cables are expected to be in place by the second week in July.

The Receiver Building at Town Hill was completed except for permanent doors and windows. The diesel generators arrived on June 20 and were placed in the power building, which lacks only the final painting and trim to be completed. The grating and handrails for the AR tower arrived and were installed. The existing cable between South Road and Town Hill was staked out, with the assistance of Air Force personnel, in preparation for laying the new cable.

ATLANTIC SHIP

The schedule for the Atlantic Ship, *Rose Knot*, was moved up to allow for interference test. The *Rose Knot* arrived in Jacksonville, Florida, on June 24 and modification work began on June 27. This work is scheduled for completion on August 15 and the BRI is August 31.

All steerable antenna tower work, together with the new kingpost, was prefabricated. This included the placement of grating, mounting of the platform access doors, and prime painting. The antenna tower platform for the top of the mainmast was also prefabricated.

The motor generator sets and switchgear are scheduled to arrive at the Gibbs shipyards on July 27 and August 2, respectively.

GRAND CANARY ISLAND

Construction is proceeding on schedule and is expected to be completed by July 12. The BRI for this site is July 25. During the month, installation of ductwork for the air-conditioning system at the T&C Building began and transformers at the S-band radar tower were installed. Interior lighting, fixtures, electrical wiring, and partitions were installed at the diesel generator and T&C buildings. The two buildings are being painted and entrance roads and parking areas for both are completed. The major items yet to be installed are the fencing for all areas and the completion of the power line to the Verlor radar. Preliminary testing of the power and air-conditioning circuits will begin on June 20.

All prepurchased equipment has been delivered to the site with the exception of some accessories. These accessories have been purchased and are being expedited.

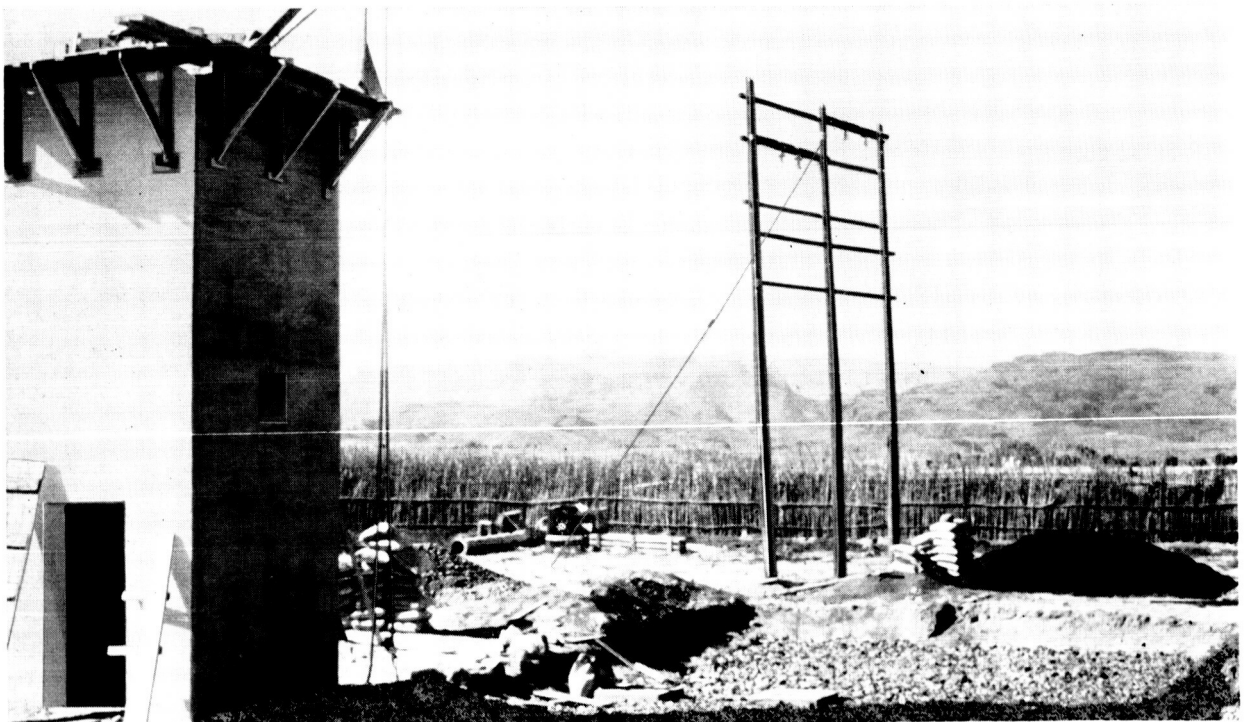
KANO, NIGERIA

Award of construction contract was made and construction began on June 8 at both the Dorayi site and the Posts and Telegraphs transmitter area. The generator building and the T&C Building for both locations were staked out and work began on the construction of field offices.

Cable trays, power distribution panel, and the fire detection system arrived in Lagos, Nigeria, on June 6. This equipment, plus the



General Construction progress at Bermuda. The FPS-16 Building is on the right and the Telemetry, Control, and Computer Building is on the embankment in the rear.



The Verlor antenna tower casts its shadow across the van hardstand foundation on Grand Canary Island



Native workers excavating the foundation for the Telemetry Building at Zanzibar.

prepurchased equipment which arrived on May 20, was stored under full security at Lagos, pending the award of a construction contract, and is now being shipped by the contractor to the site. The remaining prepurchased equipment is now en route via commercial overseas transportation and is scheduled to arrive at the site by July 23.

ZANZIBAR

Site construction began on May 24 and all work is scheduled for completion by August 1. Excavations for field office, power building, T&C Building, and the transmitter building are complete. Road construction by the Zanzibar Public Works Department was started May 2 and was scheduled for completion by the end of the month.

All prepurchased equipment, except switch-gear, water treatment equipment, fire-fighting gear, and submersible well pumps, are en route and will arrive at the site by July 8. The remaining equipment was scheduled to depart from New York City on June 24 and arrive at the site on August 15.

INDIAN OCEAN SHIP

Modification work on the *Coastal Sentry* is on schedule. To allow for interference test, this work is now scheduled for completion on July 12 and installation will begin on July 29. The survey, to determine structural and electrical incompatibilities, was conducted by W.E. and indicated a need for further modifications to the deck structure and supports for all HF radio antennas.

All structural work on the steerable antenna tower platform for the acquisition antennas was completed except for mounting facilities for replacement of AMR's VHF antenna. The steerable transmitting and receiving antenna tower platform was completed, including structural reinforcement of the supporting bulkheads.

AMR equipment in the telemetry room was made dustproof by sealing under plastic sheets. Heating and ventilation was arranged so as to keep the relative humidity below 50% during

construction and alteration work. Air duct installation was completed.

The radio transmitter and generator rooms were stripped and the hatchway between the floor of this space and the ceiling of the telemetry room was enlarged so that Bendix equipment could be brought into the telemetry room. Other structural changes were made to permit moving equipment into the air-conditioning equipment room.

On June 17, W.E. forwarded a letter to NASA describing a survey and recommendations for shipboard modifications which are necessary to improve performance of the electronic equipment.

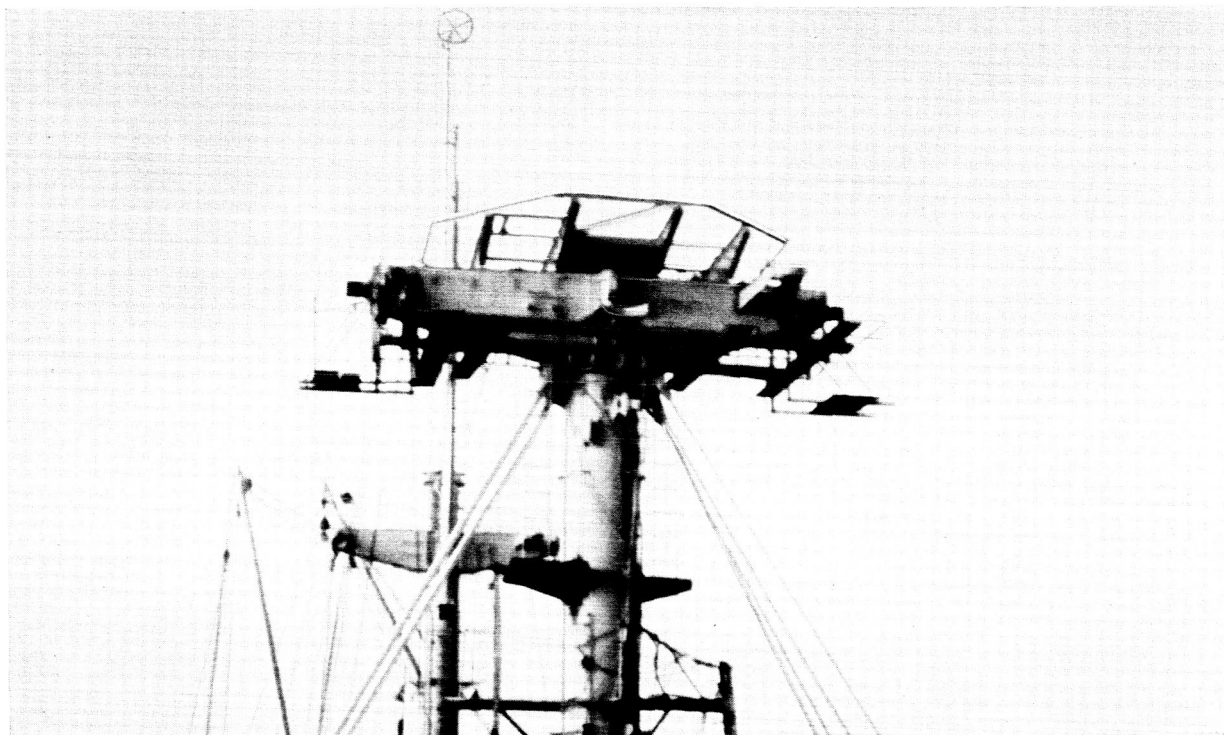
On June 20, W.E. furnished B&R revised sketches for the horizontal cage receiving antenna. The revision was necessary to reduce structural requirements and to eliminate the conductive materials for mounting this type of antenna configuration.

MUCHEA, AUSTRALIA

Construction was continuing on schedule and the BRI of October 1 was expected to be met by W.R.E. The steel structure for both the T&C Building and the generator building was completed. The concrete subfloor for the T&C Building was 80% complete and all requested conduits have been provided. Concrete work for the boresight towers is completed and the towers were being painted prior to erection. Diesel generator sets were scheduled to arrive at Fremantle on June 24. Arrangements were made for delivery to the site and installation was to begin upon arrival of the sets.

WOOMERA, AUSTRALIA

Construction was continuing on schedule and the BRI of October 1 was expected to be met. The concrete foundation for the T&C and generator buildings was completed and the steel framework for the generator building was erected. The service road was completed except for sealing the surface. Work continued on the main waterpipe line, sewage trenches, and septic tanks. Diesel generators are expected to be installed by the middle of July.



Acquisition antenna platform on the mainmast of the Indian Ocean Ship.

CANTON ISLAND

The Seabees began construction on May 23 and all work is scheduled for completion by October 1. The erection of the campsite and the excavation and grading of the T&C Building and the generator building are complete. Work began on the outside utilities and foundations of both buildings. All towers were surveyed and staked out.

The initial shipment of prepurchased equipment arrived at Canton Island on May 18. An additional shipment arrived at Honolulu on May 30 and consideration was being given to having this and subsequent materials air-shipped from Honolulu to Canton Island.

KAUAI ISLAND, HAWAII

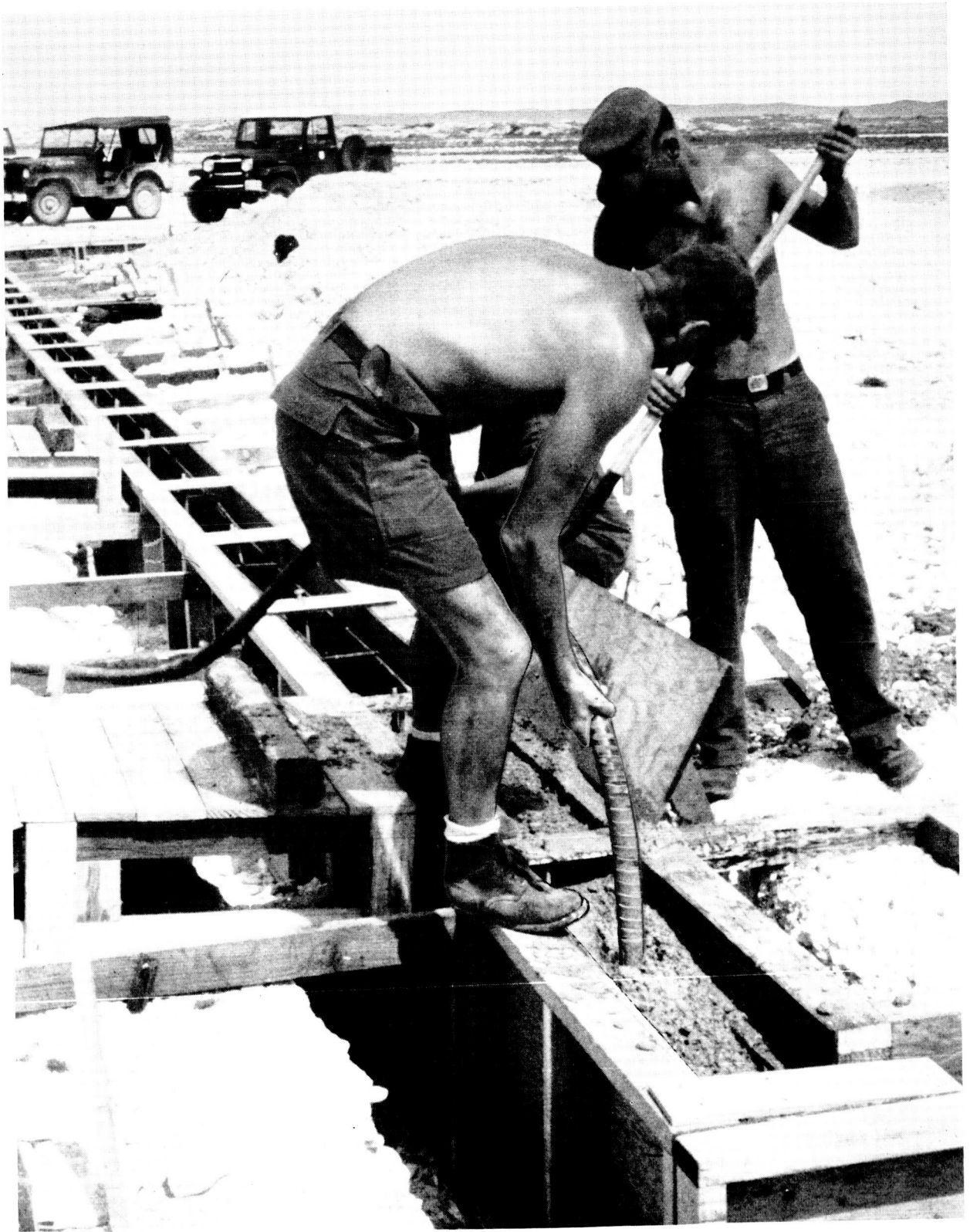
Construction is proceeding on schedule to meet a BRI of September 9. It is estimated that the T&C and the generator buildings will be completed by July 1. The S-band radar tower foundation was completed on June 19.

Types I and II antenna tower foundations were finished on June 17 and tower erection began on June 21. The Types I and III boresight tower foundations were completed on June 15 and tower erection began on June 20.

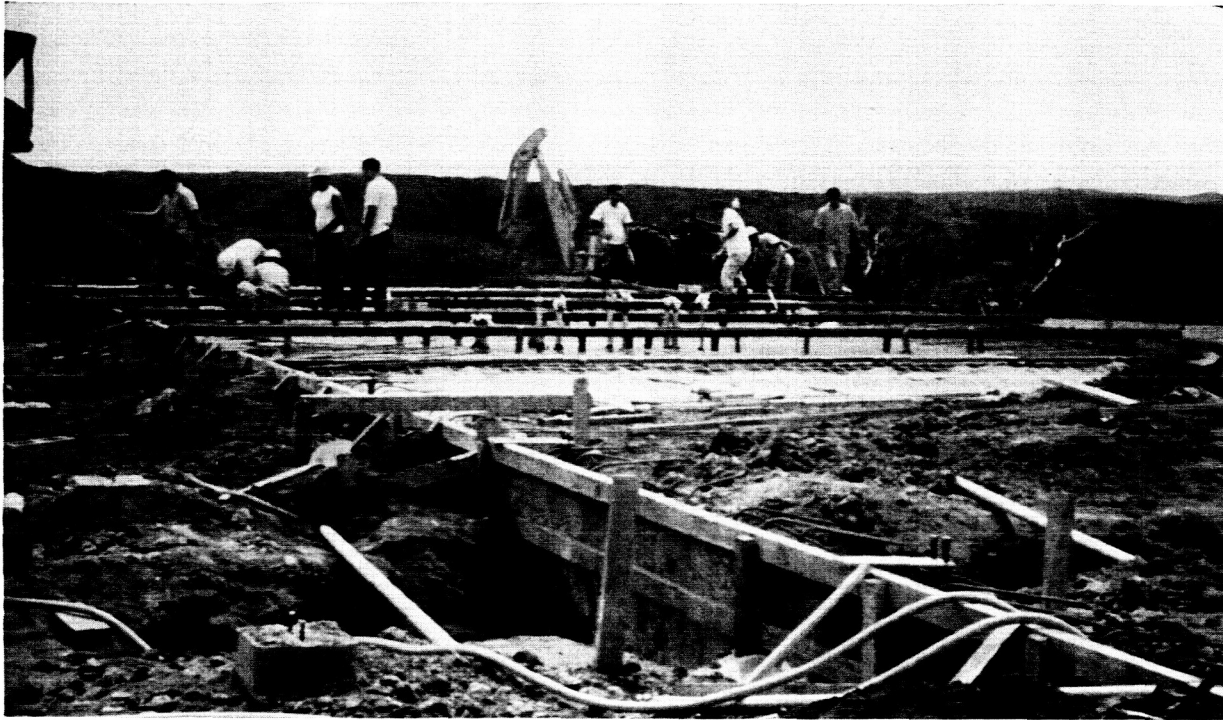
All prepurchased equipment is now on site with the exception of switchgear, motor control centers, and the fire detection system, which is scheduled to arrive by July 1.

POINT ARGUELLO, CALIFORNIA

Construction began on May 23 and is scheduled for completion by August 8 to meet a September 9 BRI. The foundations for the T&C antenna tower have been poured and tower construction began during the week of June 27. Foundations have also been poured for both telemetry towers adjacent to the telemetry building. Excavation for the four-unit generator building has been completed and foundation pouring began on June 23. Rough clearing and grading has been completed for the Verlor radar site and the access road.



Navy construction battalion personnel pouring the first concrete for the Telemetry Building on Canton Island.



Floor slab for the Telemetry and Control Building being poured, Kauai Island.

Two boxes of electronics test equipment have been received from Bendix Radio and two boxes of Milgo Corporation equipment spares are also on site and have been placed in storage. Transformers and switchgear, the only remaining pre-purchased equipment required, are scheduled to arrive on July 5 and July 15, respectively.

GUAYMAS, MEXICO

The construction contract was awarded to Chapultepec, S.A., Mexico City, D. F. Construction began on June 2 and all work is scheduled for completion by September 15 to meet the BRI of September 25.

Excavation for the generator building has been accomplished and excavation for the T&C Building is in progress. Construction is proceeding on schedule. The W.E. site manager and the B&R construction superintendent arrived on site June 4.

Architect-engineer design work concerning construction plans and specifications is complete. Site survey work was completed and information

forwarded to B&R on May 23. Soil testing was completed on June 10.

The prefabricated buildings, diesel generators, receiver and transmitter towers, and boresight towers arrived at the site June 10. With the exception of the generator switchgear, all remaining equipment has been released from the vendors' plants and is at or en route to Nogales, Arizona. This equipment is scheduled for transshipment to the site by July 1. The switchgear is scheduled to arrive at the site by July 22, which is compatible with the construction schedule.

WHITE SANDS, NEW MEXICO

Team Members comments have been received on the Implementation Plan for WSMR. The comments will be included in Issue 1 of the plan which will be prepared early in July and submitted to NASA for approval.

Construction bids for WSMR were received June 27. Awards of construction contract will be made on July 19. Construction work is to start

July 25, and be completed on September 2. The BRI is September 16.

The receiver and transmitter towers and bore-sight towers, the only prepurchased equipment required for this site, are ready for shipment. This equipment is being temporarily stored at the vendor's plant and is tentatively scheduled for delivery to the site in early July. Scheduled delivery is compatible with the site construction schedule.

CORPUS CHRISTI, TEXAS

Construction is scheduled for completion on August 8 to meet the BRI of September 10.

Prefabricated buildings, boresight towers, air-handling units, water chillers, water tower pumps, and cooling towers have been received at the site. The remaining prepurchased equipment (motor control centers, underground cables, and receiver and transmitter tower) is scheduled for delivery by July 1.

Negotiations for leased-line services required for Project Mercury are now in progress with the Southwestern Bell Telephone Company. The local power and water companies are constructing facilities for the Mercury installations at the present time.

EGLIN AFB, FLORIDA

Bids for construction were solicited on June 6 and proposals are due by June 27. Construction is scheduled to begin July 25 and to be completed September 2 to meet the September 16 BRI.

The receiver and transmitter towers and bore-sight towers, the only prepurchased equipment required for this site, are ready for shipment. This equipment is being temporarily stored at the vendor's plant and is tentatively scheduled for delivery to the site in early July. Scheduled delivery is compatible with the site construction schedule.

GODDARD SPACE FLIGHT CENTER— IBM SPACE COMPUTING CENTER

IBM and W.E. representatives met at SCC to discuss TTY and computing interface problems

involving programming. Agreements were reached on: (1) methods to be used to introduce redundancy of data brought about by the Bermuda backup routes; (2) computer input patching arrangements; and (3) a computer alarm arrangement. IBM agreed to provide a trouble printout for the GSFC computers which would be activated when a computer receives unusable data. This printout would specify TTY input over which the bad data was received and print out the bad data in blocks of 60 characters.

W.E. representatives visited SCC to assist AT&T Long Lines in testing TTY equipment and to observe any possible design trouble that might exist. It appears that the TTY input/output computer equipment is satisfactory although there is some difficulty in the computer's memory circuit. Tests are continuing so that all defects can be cleared as soon as possible.

MERCURY CONTROL CENTER

Stromberg-Carlson's installation was delayed three days during the month because of the recent strike at Cape Canaveral. All of the Stromberg-Carlson consoles for the Control Center are in place and wiring is in progress. There has been a delay in providing trend charts and summary displays. This item is promised for delivery on July 15.

Retrofit work at this site began on June 7. Design work was completed on June 10, bids solicited on June 14, and proposals received on June 24. Retrofitting began on June 27 and is scheduled to be accomplished by July 9. During the reporting period, most of the Bendix effort was devoted to the installation of telephone equipment. Wiring of the combined distributing frame in the Tel-3 Building was delayed until June 15, awaiting delivery of the cable rack. Installation in the communications equipment room is approximately half complete. Bendix installers are working two shifts on a 48-hour week to complete installation by July 9.

At the Mercury Project Managers' Meeting of June 22, Bendix Pacific indicated that decommutators will be shipped and fixed at this site. This fix involves a change in the capacitor, change in the diodes, and the addition of a

sheet-metal duct to change the direction of the cooling air. It is expected that these changes can be made in about four hours. It was also pointed out at the meeting that, although the Canoga Corporation 1864 converter and the Ampex recorder will not arrive on site until July 1, neither of these delays will affect the required dates.

The IBM installation supervisor is now at the site and the IBM equipment began arriving the week of June 20.

NASA—DEMONSTRATION SITE, WALLOPS ISLAND

During June, component demonstrations of telemetry, capsule voice, timing, data processing, and transmission equipment were conducted. Subsystem demonstration of telemetry is scheduled to start July 10 and initial dynamic testing of the site, using the instrumented aircraft, is scheduled to begin August 1. All major equipments, which were reported delayed in last month's report, were shipped or are now at the site. The only remaining shortage at this site is the dipoles for the acquisition aid equipment.

Western Electric authorized B&R to solicit bids for a retrofit construction program which is expected to begin about July 5. This work included the addition of three rooms in the hangar area of the Special Projects Building, conversion of existing lighting in the telemetry room of the Special Projects Building to dimmable control, addition of a power outlet for

the auxiliary hardstand, and addition of a guard-rail along the west edge of the Special Projects Building roof.

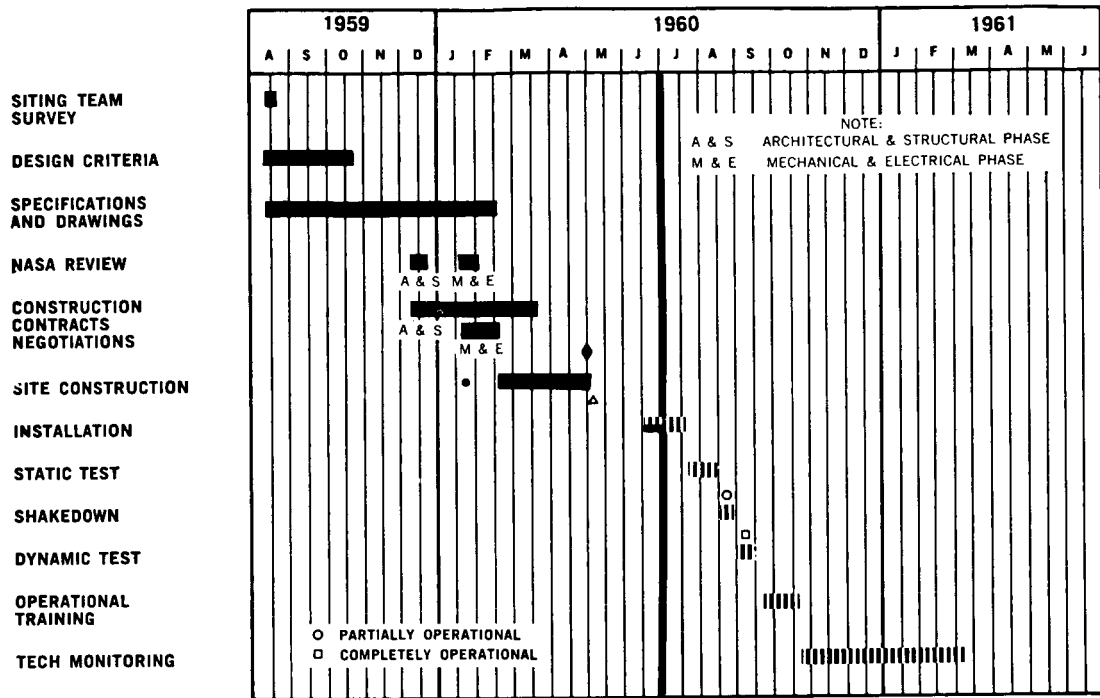
A firing of a Scout missile at Wallops Island in July is expected to provide W.E. and Team Members with an opportunity to utilize some of the Mercury equipment and demonstrate its operation.

Demonstration of high-speed data transmission was made from Wallops Island to the SCC. Data was successfully transmitted but tests were inconclusive because of the short duration and static nature of the pattern. Bendix Pacific requested that the computer program print out the results of such a transmission over a longer period to obtain an indication of the reliability of the complete loop. When the timing generator is installed and operating at Wallops Island, it will be possible to transmit the changing pattern directly from the radar readout.

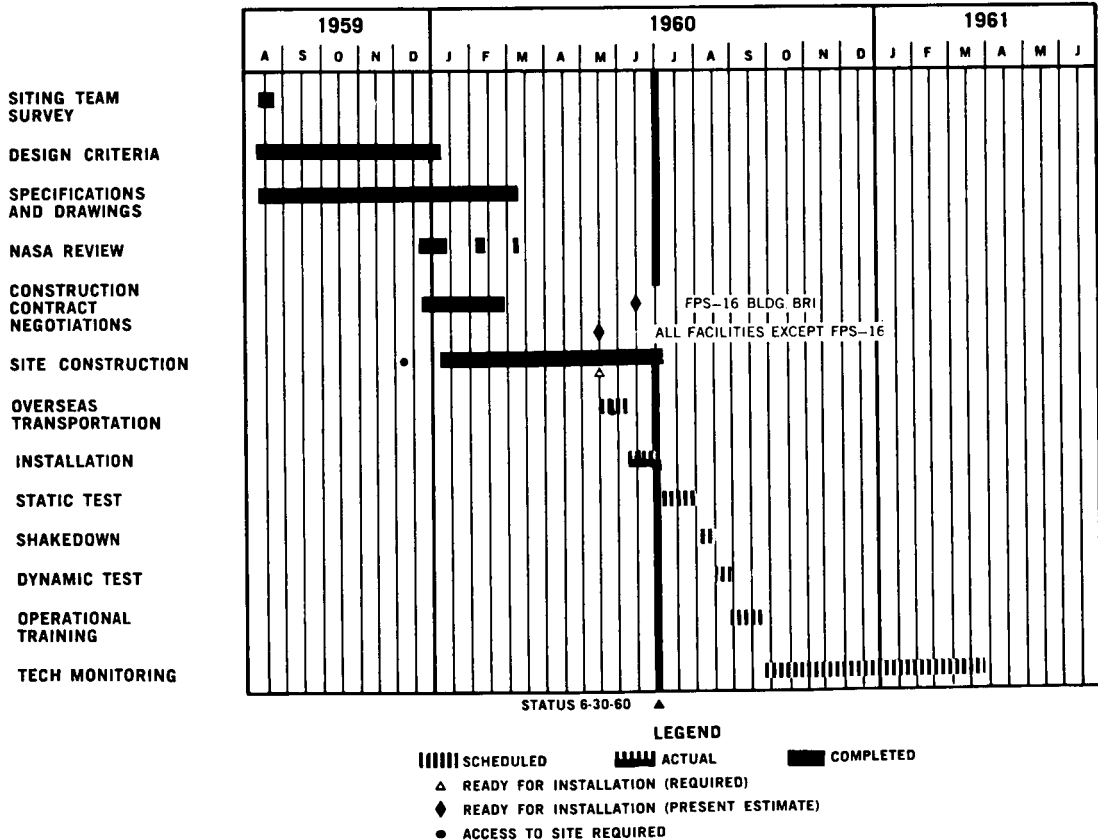
Western Electric representatives visited Wallops Island to witness Bendix Radio's demonstration for NASA of the TTY portion of the digital-to-TTY conversion subsystem. The demonstration indicated the need for more detailed instruction on TTY circuit maintenance procedures especially written for technicians who do not have experience in this field.

Equipment for the Navy recovery program will not be available to meet the August 22 schedule date desired by NASA because of late firming up of requirements. Currently, it is estimated that these facilities will be installed and tested by September 29; however, every effort is being exerted to improve this date.

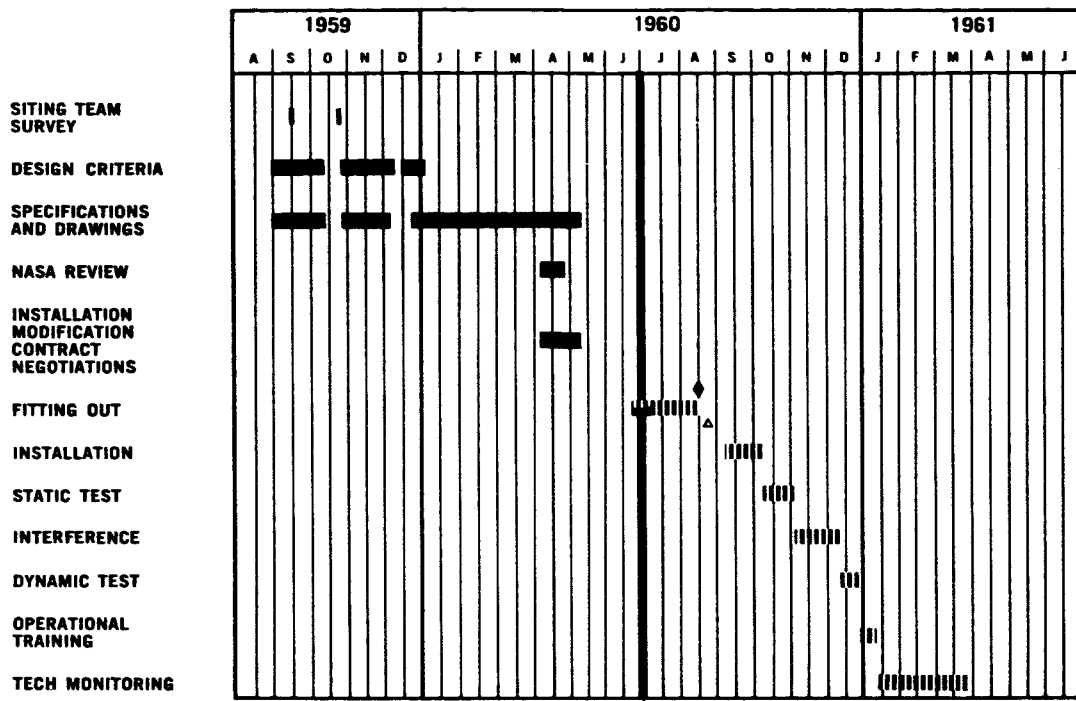
CAPE CANAVERAL, FLORIDA



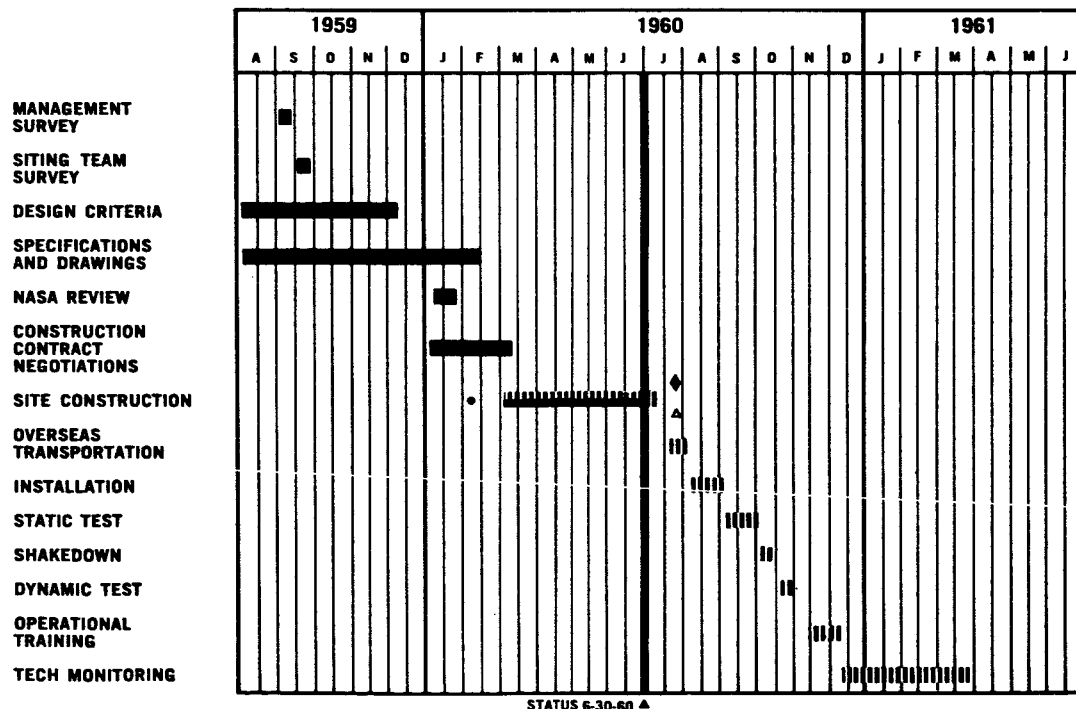
BERMUDA



ATLANTIC SHIP



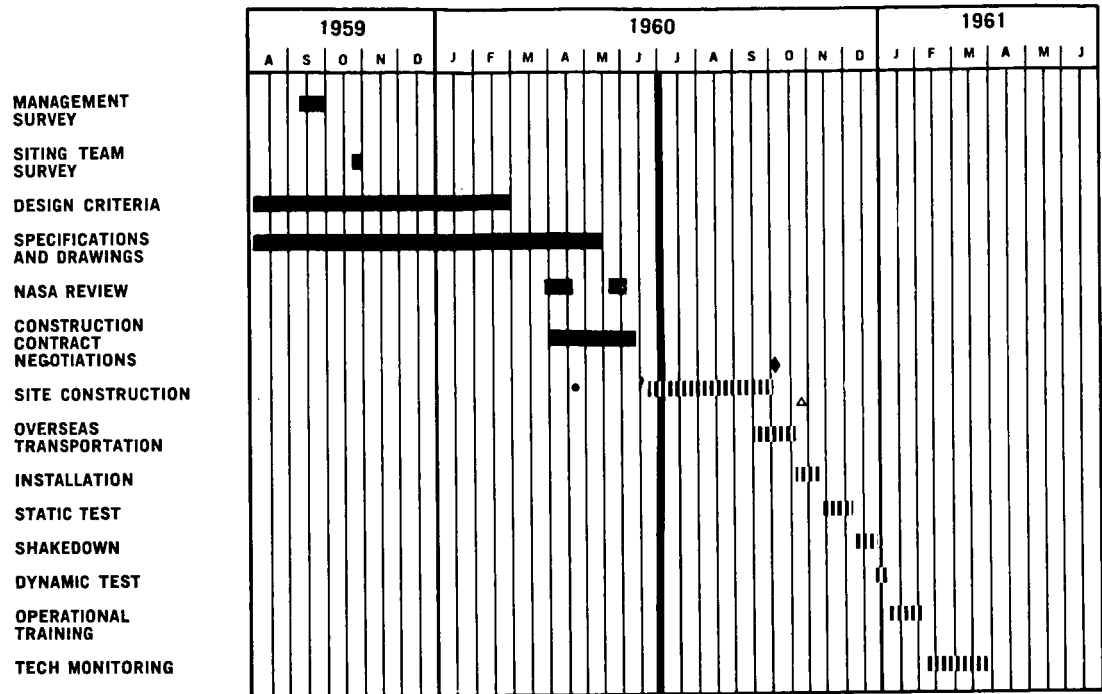
GRAND CANARY ISLAND



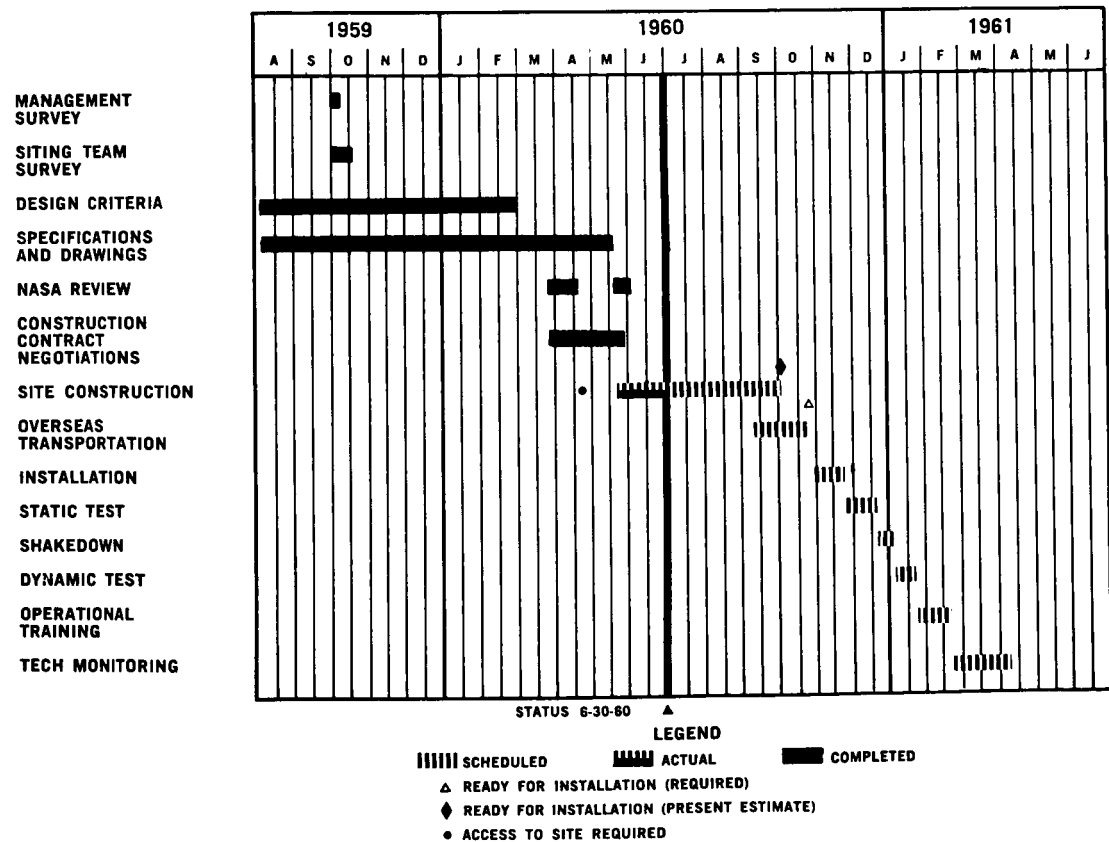
STATUS 6-30-60 ▲

LEGEND
 ||||| SCHEDULED ■■■■ ACTUAL ■ COMPLETED
 ▲ READY FOR INSTALLATION (REQUIRED)
 ◆ READY FOR INSTALLATION (PRESENT ESTIMATE)
 ● ACCESS TO SITE REQUIRED

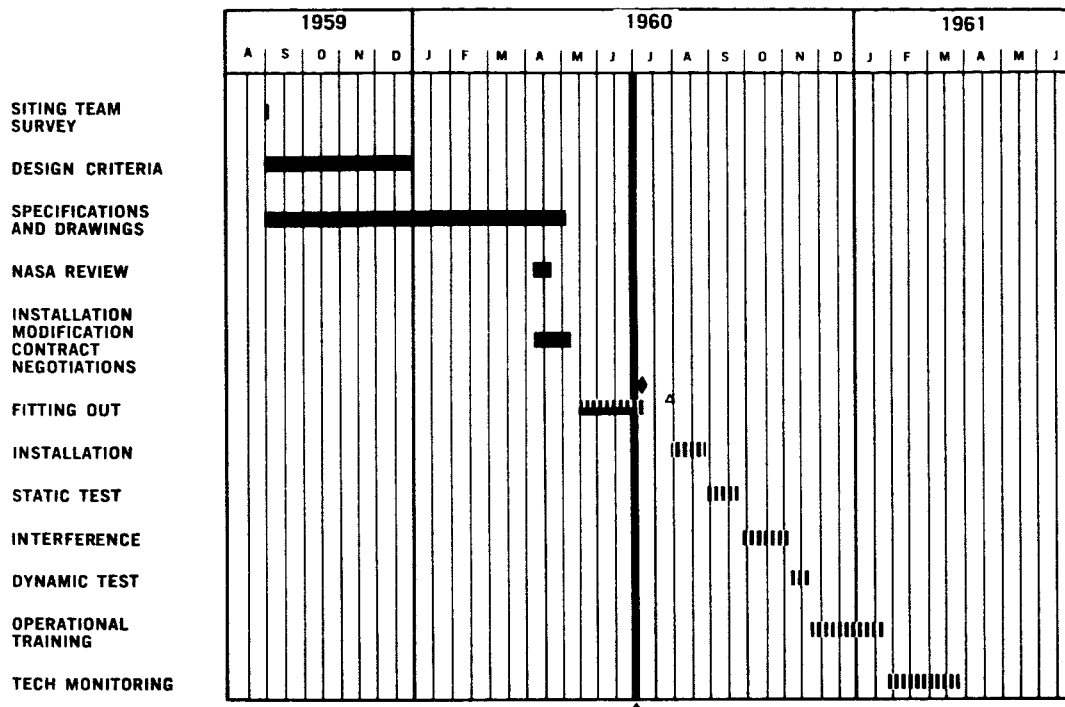
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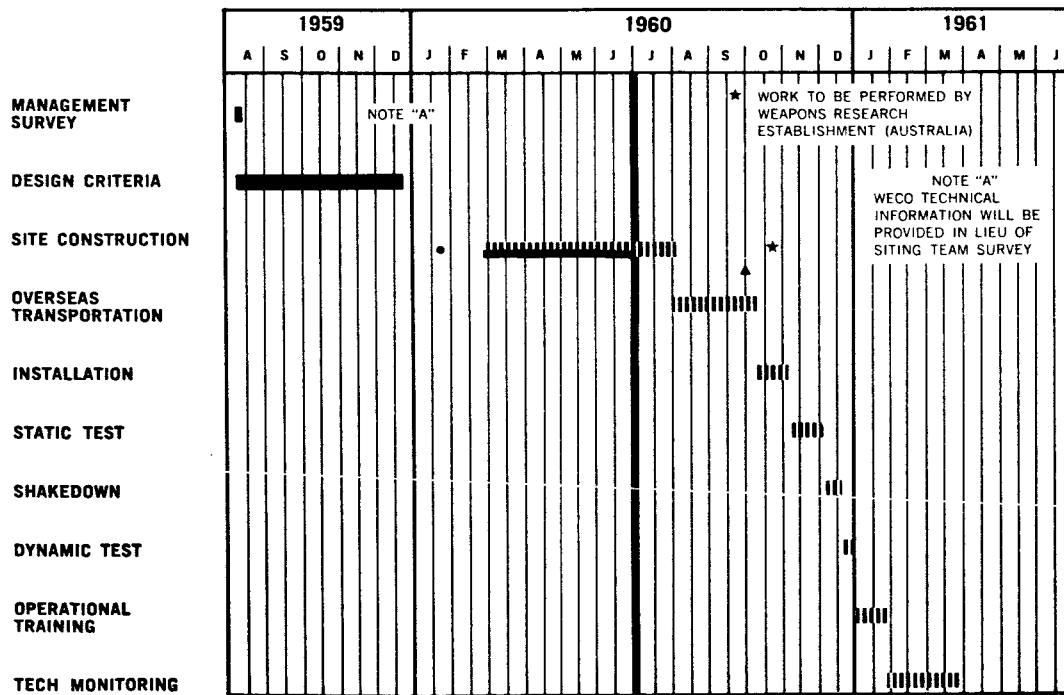
ZANZIBAR



INDIAN OCEAN SHIP



MUCHEA, AUSTRALIA

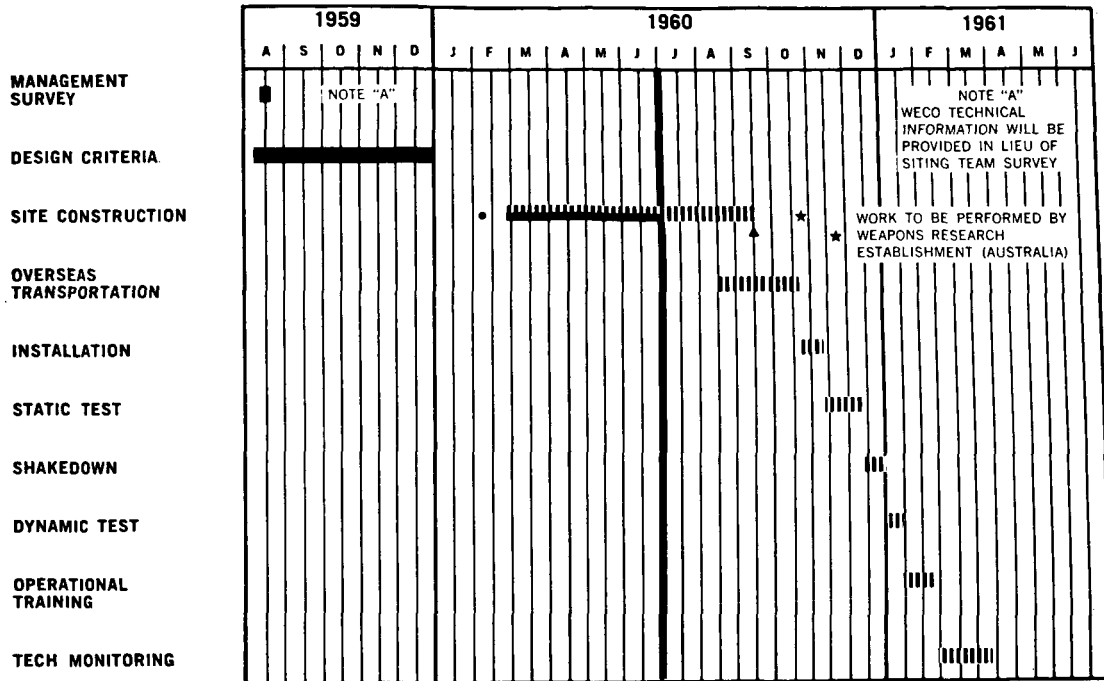


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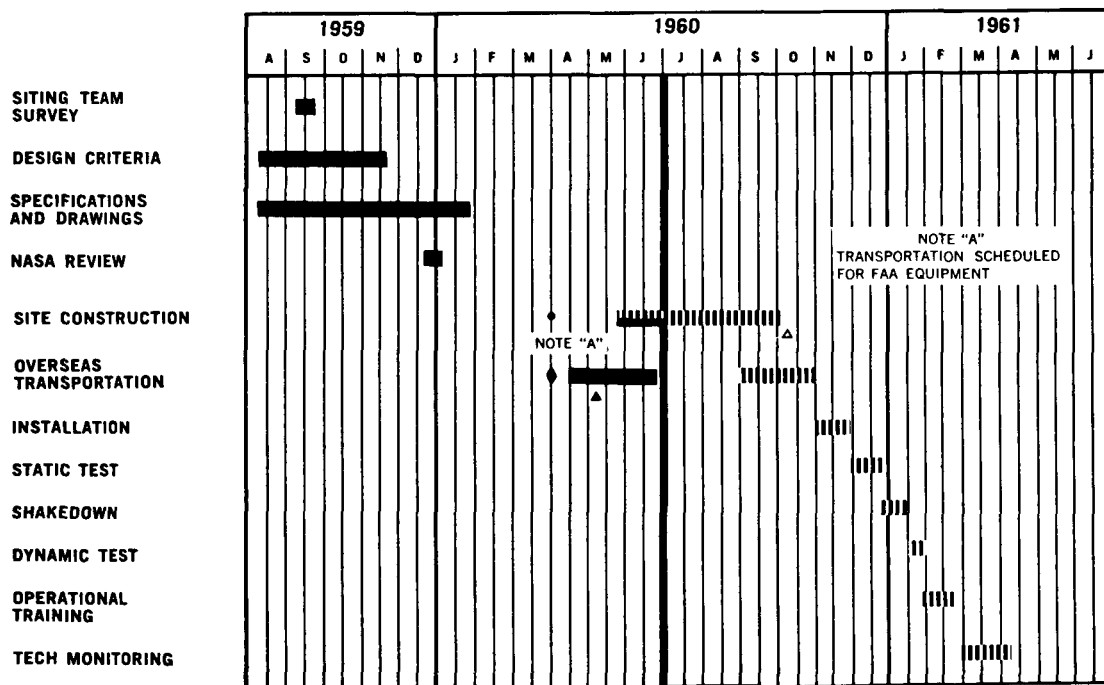
LEGEND

- ||||| SCHEDULED
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- █████ COMPLETED
- ▲ READY FOR INSTALLATION (REQUIRED)
- ◆ READY FOR INSTALLATION (PRESENT ESTIMATE)
- ACCESS TO SITE REQUIRED

WOOMERA, AUSTRALIA



CANTON ISLAND

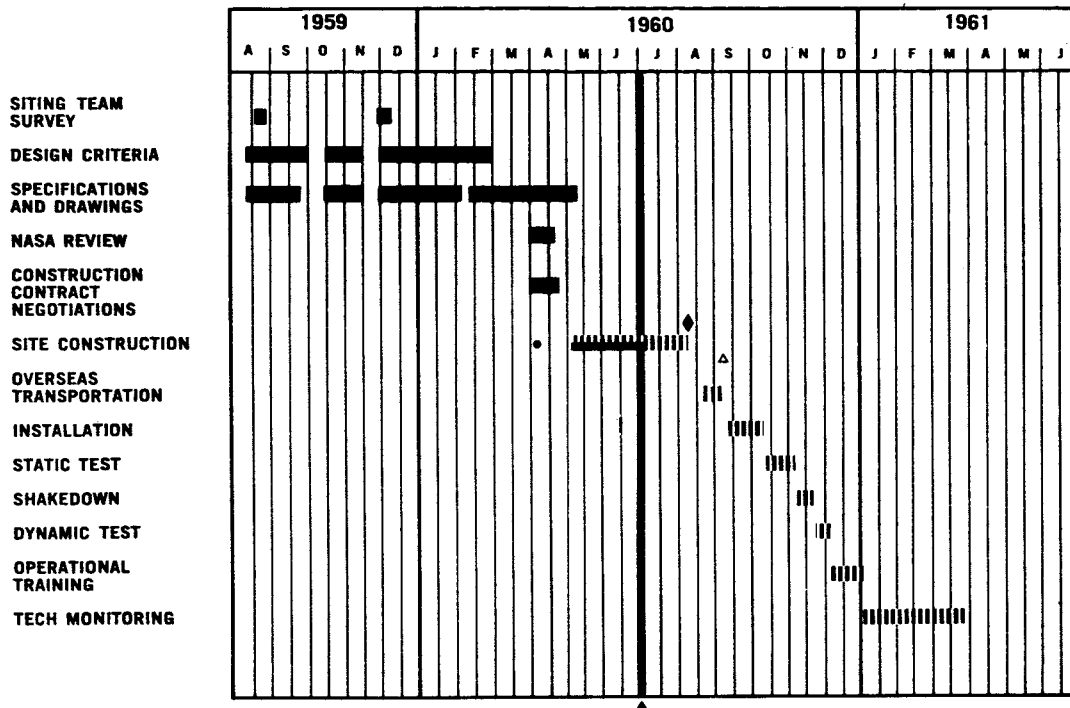


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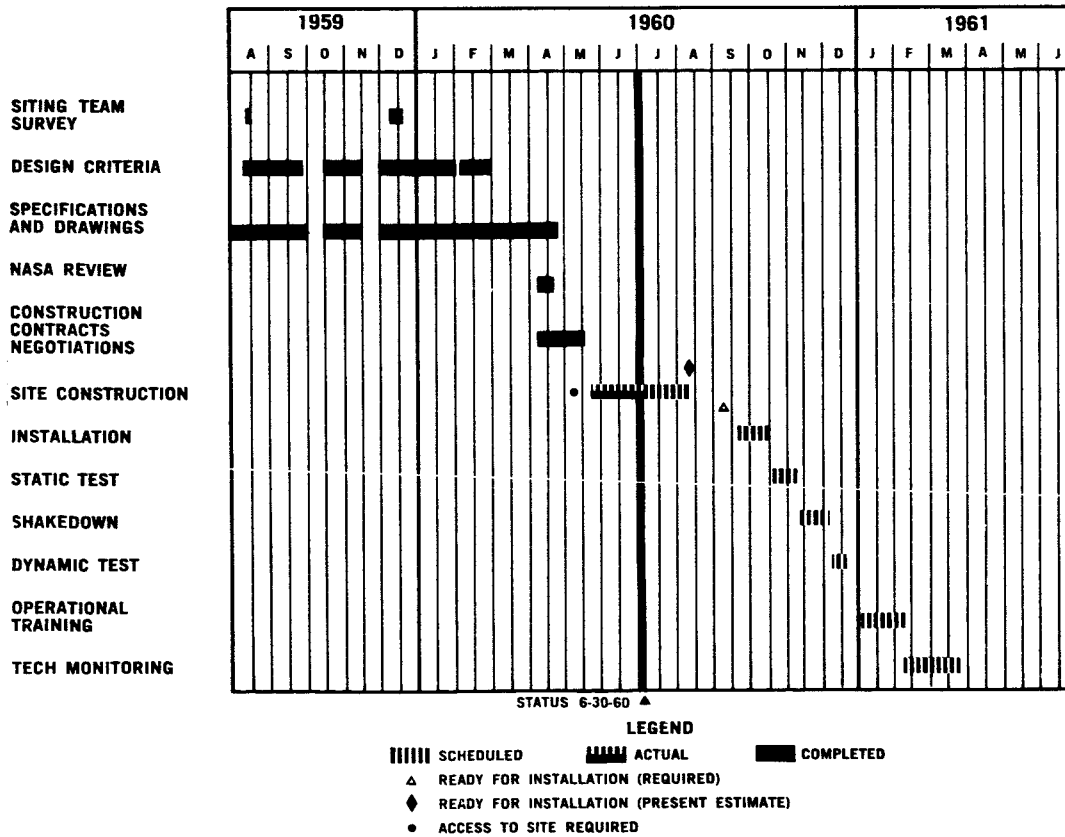
LEGEND

- ||||| SCHEDULED
- ||||| ACTUAL
- COMPLETED
- ▲ READY FOR INSTALLATION (REQUIRED)
- ◆ LATEST ARRIVAL DATE AT WAREHOUSE
- ▲ DUE AT SITE
- ACCESS TO SIGHT REQUIRED

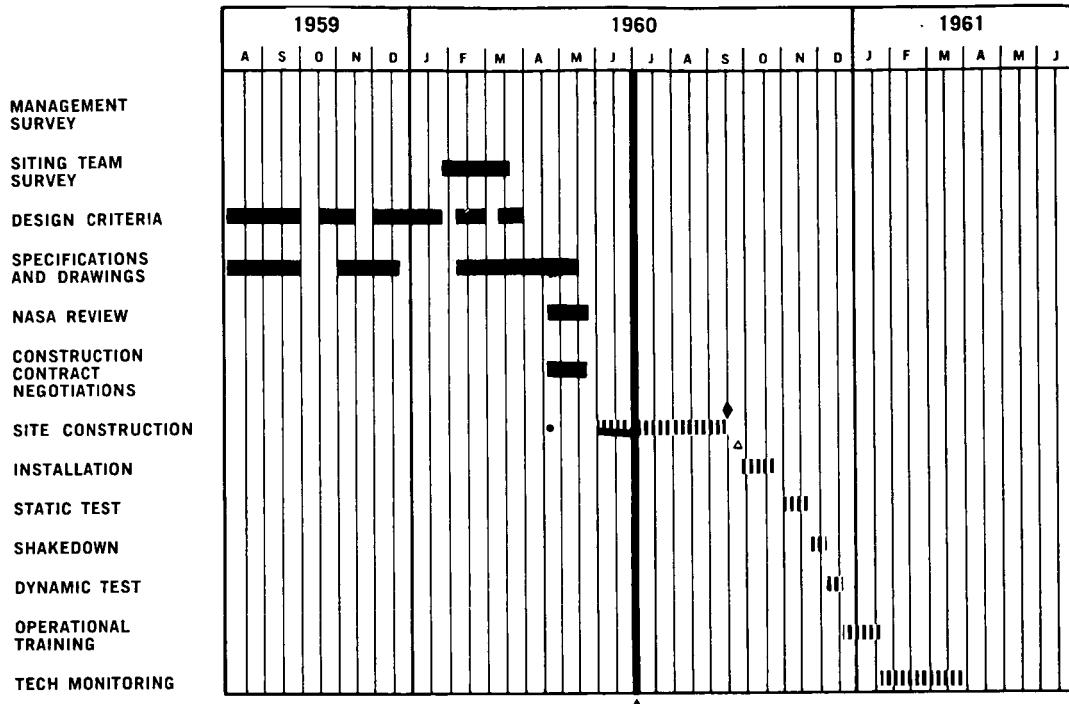
KAUAI ISLAND, HAWAII



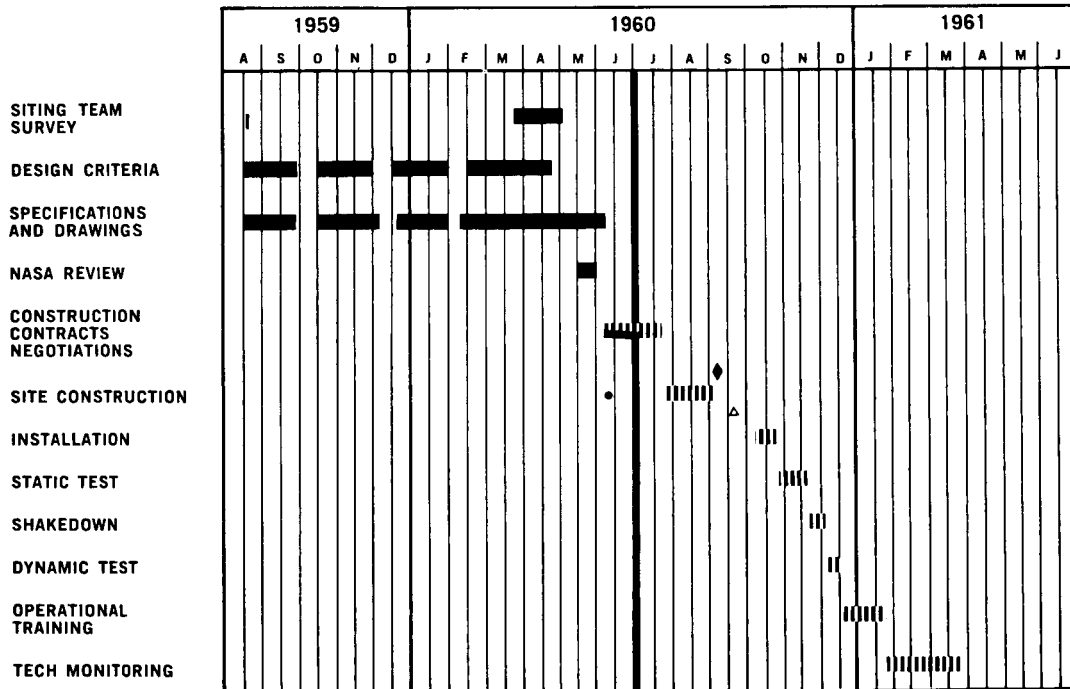
POINT ARGUELLO, CALIFORNIA



GUAYMAS, MEXICO



WHITE SANDS, NEW MEXICO



LEGEND

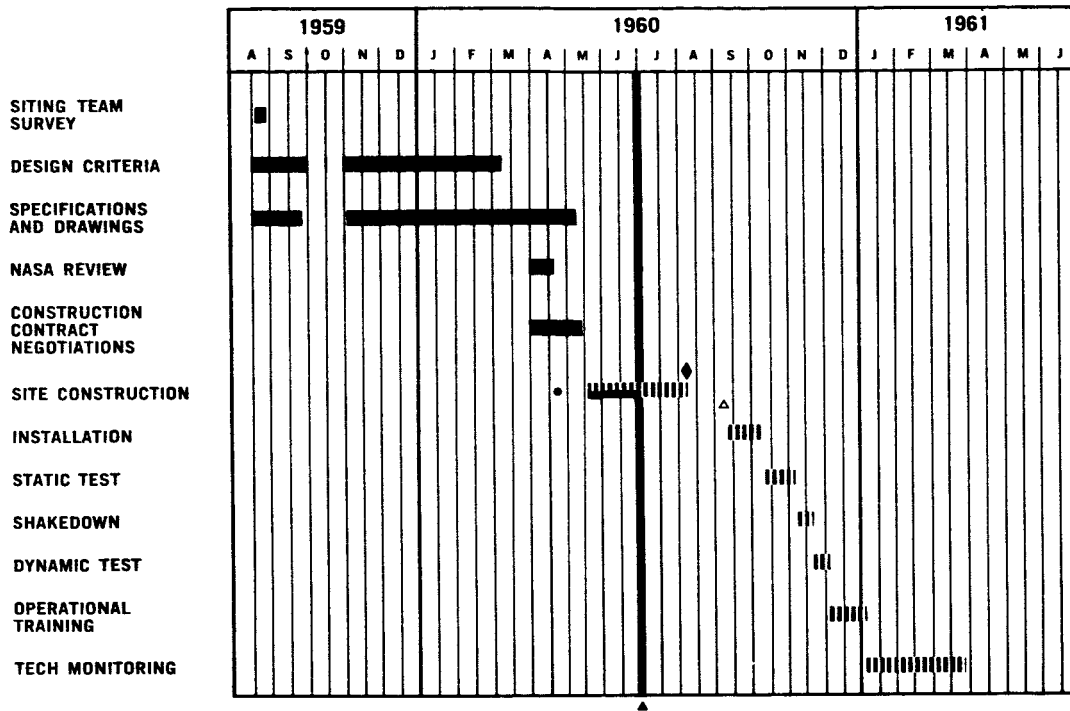
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▲ READY FOR INSTALLATION (REQUIRED)

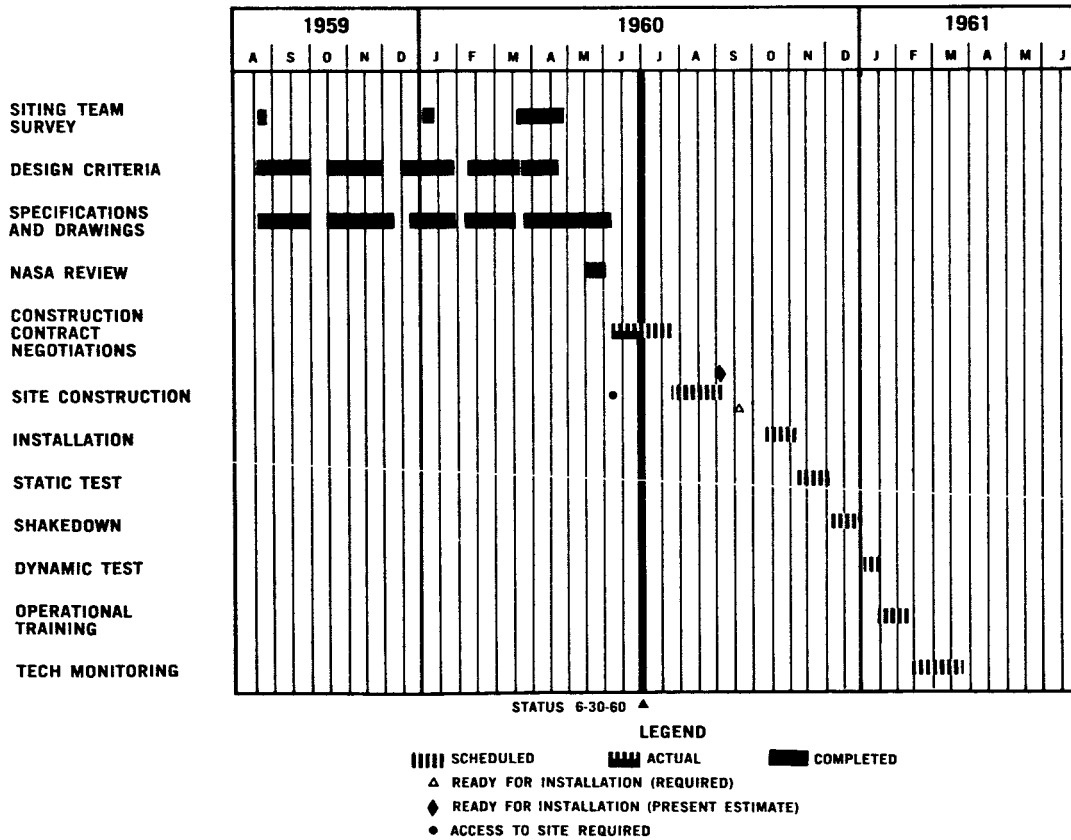
◆ READY FOR INSTALLATION (PRESENT ESTIMATE)

● ACCESS TO SITE REQUIRED

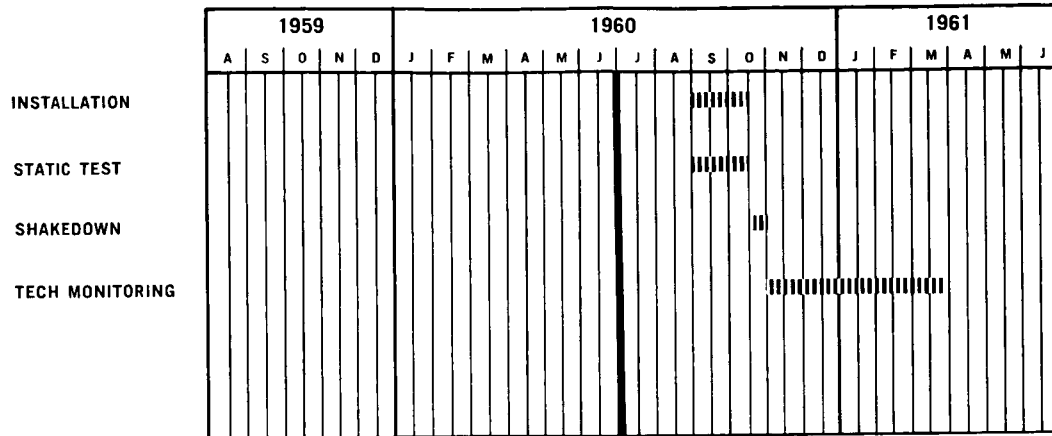
CORPUS CHRISTI, TEXAS



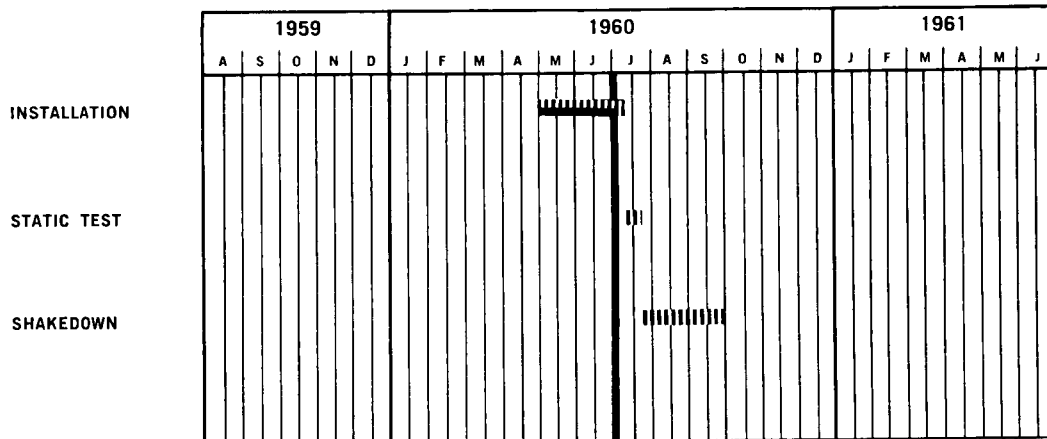
EGLIN AFB, FLORIDA



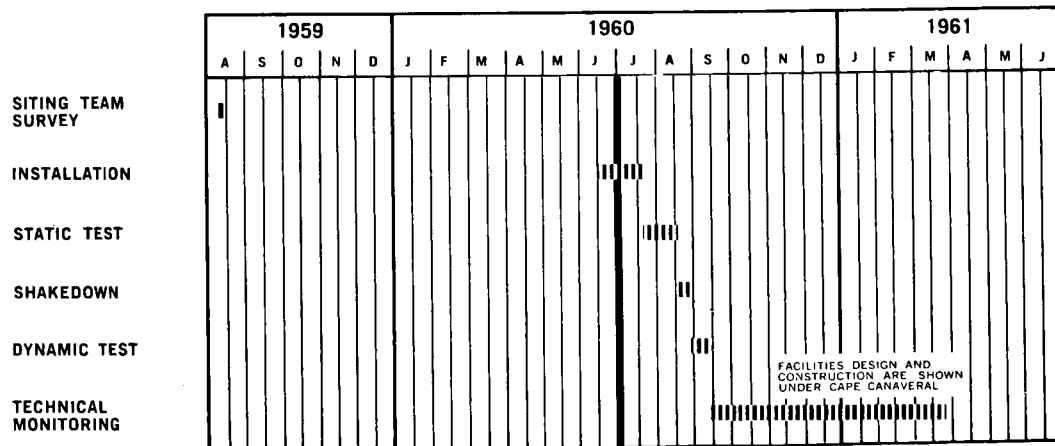
GODDARD SPACE FLIGHT CENTER



IBM SPACE COMPUTING CENTER



MERCURY CONTROL CENTER



FACILITIES DESIGN AND
CONSTRUCTION ARE SHOWN
UNDER CAPE CANAVERAL

STATUS 6-30-60 ▲

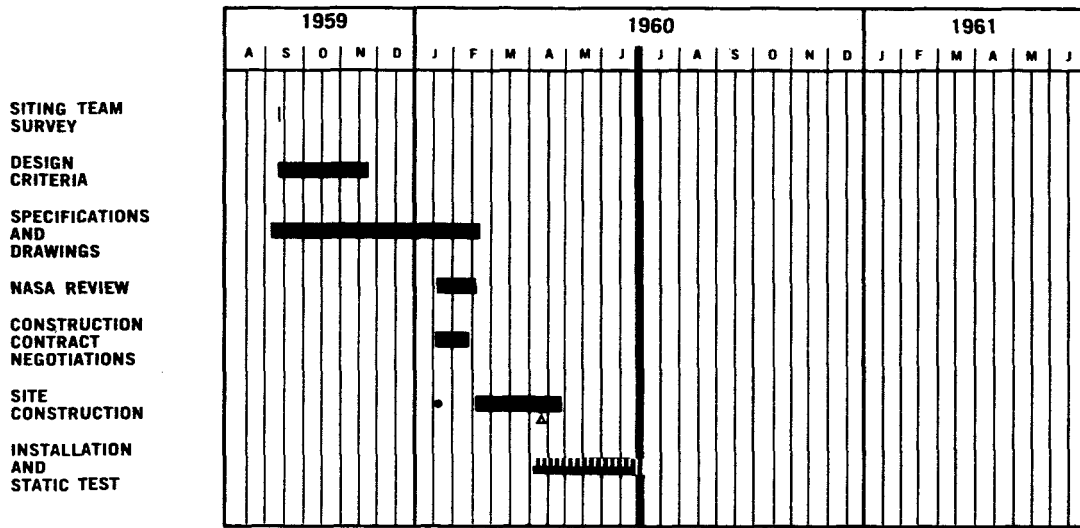
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NASA - DEMONSTRATION SITE, WALLOPS ISLAND

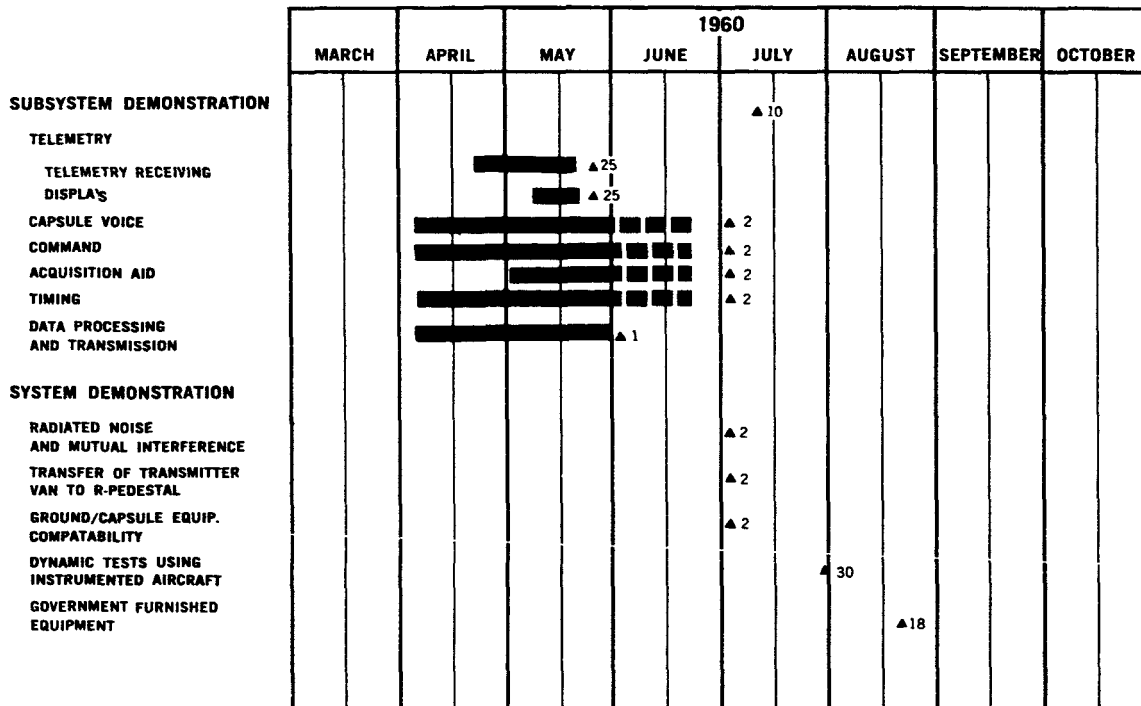


STATUS 6-30-60 ▲

LEGEND

- ||||| SCHEDULED
- ||||| ACTUAL
- COMPLETED
- ▲ READY FOR INSTALLATION (REQUIRED)
- ACCESS TO SIGHT REQUIRED

SUBSYSTEMS AND SYSTEMS DEMONSTRATION (DEMONSTRATION SITE)



LEGEND

- EQUIP. INSTALLATION PERIOD, ASSUMING GFE EQUIP. AVAILABLE
- ▲ START OF DEMONSTRATION
- COMPLETED

APPENDIX

LIST OF ABBREVIATIONS

A/D	—Analog-to-digital	M & O	—Maintenance and operation
A/E	—Architect/engineer	MATS	—Military Air Transportation Service
AFATC	—Air Force Air Training Command	MCO	—Mercury Change Order
AFBMD	—Air Force Ballistic Missile Division	MOPIS	—Missile Operations Intercom System
AFC	—Automatic frequency control	MSTS	—Military Sea Transportation Service
AFMTC	—Air Force Missile Test Center	NAS	—Naval Air Station
AMR	—Atlantic Missile Range	NASA	—National Aeronautics and Space Administration
APGC	—Air Proving Ground Command	NBS	—National Bureau of Standards
AR	—Acquisition and receiving	NEL	—Navy Electronics Laboratory
ARDC	—Air Research and Development Command	PAX	—Private automatic exchange
ATR	—Acceptance Test Requirement	PBX	—Private branch exchange
B&R	—Burns and Roe, Inc.	PMR	—Pacific Missile Range
BRI	—Building ready for installation	POE	—Port of Embarkation
BTL	—Bell Telephone Laboratories	R & D	—Research and development
C & E	—Communications and electronics	SAG	—Systems Analysis Group
CCN	—Contract Change Notification	SCC	—IBM Space Computing Center
D/A	—Digital-to-analog	SEG	—Systems Engineering Group
DOD	—Department of Defense	SOS	—Share Operating System
ECP	—Engineering change procedure	STG	—Space Task Group
EGTR	—Eglin Gulf Test Range	STL	—Space Technology Laboratory
EKG	—Electrocardiogram	TAGIS	—Tracking and Ground Instrumentation System
ESC	—Engineering Steering Committee	TLM	—Telemetry
FAA	—Federal Aviation Agency	TTY	—Teletypewriter
FORTTRAN	—Formula translating	Verlort	—Very long-range tracking
GEEIA	—Ground Electronics Engineering Installation Agency	VOR	—VHF omnirange
GFE	—Government-furnished equipment	W.E.	—Western Electric Company
GSA	—General Services Administration	W.R.E.	—Weapons Research Establishment
GSFC	—Goddard Space Flight Center	WSMR	—White Sands Missile Range